Seafood Supply Chain Quality Management:

The Shrimp Supply Chain Quality Improvement Perspective of Seafood Companies in the Mekong Delta, Vietnam

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Abstract

In recent years, food quality and safety has become an issue of critical importance to all food businesses. Several examples of food quality and safety incidents have been highlighted in the media. These things have increased public concern regarding the safety of food supply in general and high-risk products in particular. Consumers and governments are demanding safe food, and these demands are being passed back along each step of the food supply chain, ultimately ending with the food producers. For different segments of the supply chain, special Quality-Assurance (QA) programs have been developed, in response to perceived risks, potential price premiums and customer requirements. Such QA programs, of which the Hazard Analysis and Critical Control Points (HACCP) methodology is the most important in terms of international trade and food quality and safety. The absence of such systems will increasingly constitute a barrier to accessing export markets.

The present research deals with Seafood Supply Chain Quality Management - The Shrimp Supply Chain Quality Improvement Perspective of Seafood Companies in the Mekong Delta (Vietnam). It will show the development of a supply chain quality management framework through a techno-managerial approach. The framework includes measures for shrimp quality and safety assurance (i) in primary production, such as supplier quality management and partnerships; (ii) at company level such as quality management, especially HACCP implementation; and (iii) at the distribution stage with focusing on storage and transportation. In addition, the framework demonstrates roles of the government, local agricultural departments, the Vietnam Association of Seafood Exporters and Producers (VASEP) and The National Fisheries Quality Assurance and Veterinary Directorate (NAFIQAVED) that are crucial for achieving quality and safe objectives for Vietnam's seafood in the entire chain, especially in primary production. The products of the research also provide a quality improvement process for the seafood companies and potential measures to improve further product safety and quality in the chain.

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Glossary of Acronyms

BRC	British Retail Consortium
CCP	Critical Control Points
DF	Department of Fisheries
DST	Department of Science and Technology
EC	Extension Centre
EU	European Union
FRDP	Fisheries Resource Development & Protection
FS	Food Safety
GHP	Good Hygiene Practices
GMP	Good Manufacturing Practice
HACCP	Hazard Analysis and Critical Control Points
HCMC	Ho Chi Minh City
ICMSF	International Commission of Microbiological Specifications for Foods
ISO	International Standard Organization
MBV	Monodon Basulovirus
MD	Mekong Delta
NACMCF	National Advisory Committee for Microbiological Criteria for Foods
NAFIQACEN	National Fisheries Inspection and Quality Assurance Centre
NAFIQAVED	National Fisheries Quality Assurance and Veterinary Directorate
OASIS	Organization for the Advancement of Structured Information Standards
PL15	Size of shrimp seed ready for the farmers to breed
QA	Quality Assurance
QC	Quality Control
QM	Quality Management
SCM	Supply Chain Management
SEAPRODEX	Sea Product Import-Export Corporation
SFCs	Seafood Companies
SOEs	State Owned Enterprises
SQF	Safe Quality Food
SSOP	Sanitation Standard Operation Procedures
SWOT	Strengths, Weaknesses, Opportunities, Threats
TQM	Total Quality Management
US	United States
USDA	United State Department of Agriculture

VASEP	Vietnam Association of Seafood Exporters and Producers
VCCI	Vietnam Chamber of Commerce and Industry
WHO	World Health Organization
WSD	White Spot Disease
YHD	Yellow Heat Disease

Chapter 1

Research Introduction

At present (2002), Vietnam's seafood products in general and shrimp products in particular face many quality control challenges throughout the product range – particularly in export markets. Incomplete quality control during the primary production has caused hazardous infections in raw materials. The lack of strict quality management and modern technological investments during processing and distribution, especially the insufficient application of Hazard Analysis and Critical Control Points (HACCP), continues to lead to hazardous infection in final products. As a result, Vietnam's seafood products do not meet customer requirements and expectations with respect to product quality. This is one of the reasons why research on quality control management in the seafood supply chain – the Shrimp Supply Chain Quality Improvement Perspective for Seafood Companies (SFCs) in the Mekong Delta (MD), Vietnam – is being conducted. Chapter 1 will describe in more detail the present seafood situation in Vietnam. More specifically, it will present the background and necessary information for establishing research problems, the research objective, the research structure, methods, and methodology. The changes of these situations in the coming years will be discussed in a Section 7.4 of Chapter 7.

1.1 Common problems in global food safety and quality

Food quality assurance is now recognized as essential for an efficient and internationally competitive business. International markets demand that all steps in the food supply chain take customer and consumer preferences fully into account, that suppliers meet tighter food hygiene and safety standards, and assure constant quality. Indications are that world food suppliers will be required to provide food safety and quality assurances by the year 2010. Global trends that have an impact on food safety and quality assurance can be summarized as follows (Vietnam Economic Review, 2002):

- The demand for food is at the cost of economic growth;

- The demand for 'safe food' is increasing;
- The demand for 'quality assured' food is increasing;
- Business structures are changing; and
- Food-borne illnesses occur more frequently.

The World Health Organization (WHO) reports a rising number of food-borne illnesses in industrialized countries. The potential causes of these increased food-borne illnesses include:

- The growing amount of immune-compromised elderly people in the population worldwide;
- The emergence of new pathogens or of antibiotic resistance in pathogens;
- Changes in food handling, storage and preparation practices; and
- The growing movement of people, live animals, and food products across borders, which causes disease to spread more widely and more quickly.

The continuation of the modest world economic growth is expected to result in continuingly strong consumer demand, particularly in the developed countries of the world. Moreover, the continued economic recovery in Asian countries may lead to an increased demand for food. Consumers are increasingly concerned about food quality and safety issues. Governments all over the world have introduced legislation to compel the adoption of the HACCP systems in order to ensure that companies can prove whether food safety requirements have been met. HACCP has become the accepted method to ensure safe foods worldwide, because HACCP is the disciplined application of science to each specific food process in order to identify, evaluate and control potential hazards to food safety. HACCP is a prevention-based system, since the emphasis is on identifying hazards before they do any damage.

In addition, because HACCP is exclusively concerned with preventing illness, a basic understanding of the typical food-borne illness agents is necessary. We cannot all be microbiologists, but everyone who is in charge of food production should recognize the micro-organisms that make foods unsafe and they should understand their potential for growth and survival on food products. Stated simply, food-borne illness results from contaminated foods. The contamination may be physical, chemical, or biological. It should be pointed out that there is a great need to control these contaminations; these controls are usually included in a Sanitation Standard Operations Procedure (SSOP) and are not dealt with as part of the HACCP system. An SSOP is generally regarded as one of the prerequisites for the development of HACCP.

A few global retailers, processors and food service corporations increasingly dominate global trade. The emergence of supermarket chains in international business has very much influenced the demand for a consistent supply of safe

quality food. Food safety and quality is a potential trade barrier if exporters cannot deliver safe food all the time.

Laws have been implemented in Australia, Europe and the US to compel the adoption of the HACCP systems in the food industry. In Europe and the United States the food industry now focuses on HACCP methodology, and this activity now surpasses the use of ISO 9000 quality management systems within the food industry. The verification of product safety/quality through HACCP in order to ensure consumer safety and satisfaction has a major impact on primary producers and food manufacturers around the world. The adoption of HACCP in quality systems at all crucial points in the supply chain is increasing.

Consumers now tend to emphasize product quality and hygiene rather than quantity, which leads to increased competition with respect to product quality. There is a growing customer demand for stable and high quality products. Therefore, manufacturers and traders have no choice but to make good products and to control product quality. In the case of seafood, for instance, consumers want to buy aquatic products with high quality, hygiene and safety (Vietnam Economic Review, 2002). Regarding shrimp products, in the Global Shrimp Outlook Conference (GSOL) experts announced that criteria used for the inspection of product safe and quality assurance will be considered very strictly by import markets (GSOL, October 2005). So what should seafood firms all over the world, including Vietnam's seafood companies, do in order to satisfy consumer requirements and expectations?

In recent years Vietnam has paid particular attention to seafood quality, safety and hygiene. The Ministry of Fisheries issued several policy directives and regulations along with financial loan priority for quality improvement, so that local governments and SFCs can improve seafood materials and finished products with the aim of meeting customer expectations. To meet customer needs, both Vietnam's seafood exporters and the biggest seafood export countries in the world, such as Thailand, China and Norway, are all trying to develop and promote quality improvement in the supply chain in aquaculture, marine catch, processing, and distribution.

1.2 Vietnam's sea product problems: an overview

1.2.1 General introduction relating to seafood products in Vietnam

(see B1 and B2 of Appendix 5 for details)

There are three stages that briefly describe the development of Vietnam's fisheries industry. During the first phase – from 1957 to 1980 – Halong Canned Seafood was the first factory of Vietnam's seafood processing industry. It was established in 1957 in the north of Vietnam, and its export value was about US$1 million at that time. Inspired by this success, more than ten processing

factories were established in the south, with an export value of approximately US$30 million. Due to a subsidy mechanism, which created business inefficiency, the export value was reduced from US$21 million in 1976 to just US$11.2 million in 1980. In order to improve the strength of the seafood business, Sea Product Import-Export Corporation (SEAPRODEX) was established in 1978. SEAPRODEX still operates independently.

Between 1980 and 1990, there were more than 100 state-owned SFCs that belonged to SEAPRODEX in the three regions of Vietnam: North, Centre and South (Figure 1.1). The export value increased to US$175 million by 1989. Due to market limitations, more than 80% of the export value was exported to Japan.

Finally, between 1990 and 2000, as the many policies and laws of the Vietnamese government and its fisheries industry encouraged the development of private companies and attracted foreign direct investment, the number of SFCs increased to more than 200. Since 1998, SFCs have had the right to export directly to overseas markets. Until then, each SFC was allocated an export quota by the government.

At present, markets and products are diversified and products are exported to more than 75 countries in the world (VASEP website). There is a tendency to invest in and improve food safety requirements, to renovate processing technology, and to apply quality management systems that comply with Good Manufacturing Practice (GMP), SSOP, HACCP, Safe Quality Food (SQF), and British Retail Consortium (BRC). And a start has been made to equitize state-owned enterprises.

In 2002 Vietnam has 332 SFCs, consisting of state-owned enterprises (SOEs: 42%), private companies (40%), joint-stock companies (13%), joint-venture companies (2%), and foreign companies (3%). 70% of the SFCs is located in the southern region, 24% in the central region, and 6% in the north. SEAPRODEX, the forerunner of today's SFCs, now only includes 19 companies (13 SOEs, 5 joint stock companies and 1 joint-venture company), of which 2 are situated in the MD.

Furthermore, the Vietnamese Association of Seafood Exporters and Producers (VASEP) and The National Fisheries Quality Assurance and Veterinary Directorate (NAFIQAVED) support the SFCs with respect to seafood quality inspection, export operation, and training. The VASEP is a voluntary organization of Vietnamese enterprises that process, import, and export sea products. It was established to coordinate the joint activities of members in the various economic sectors, regardless of their production and business scale, so that they could assist one another in improving the value, quality and compatibility of Vietnam's seafood products. More than 186 SFCs (58%) are a member of VASEP but their fisheries export accounts for 90% of the national

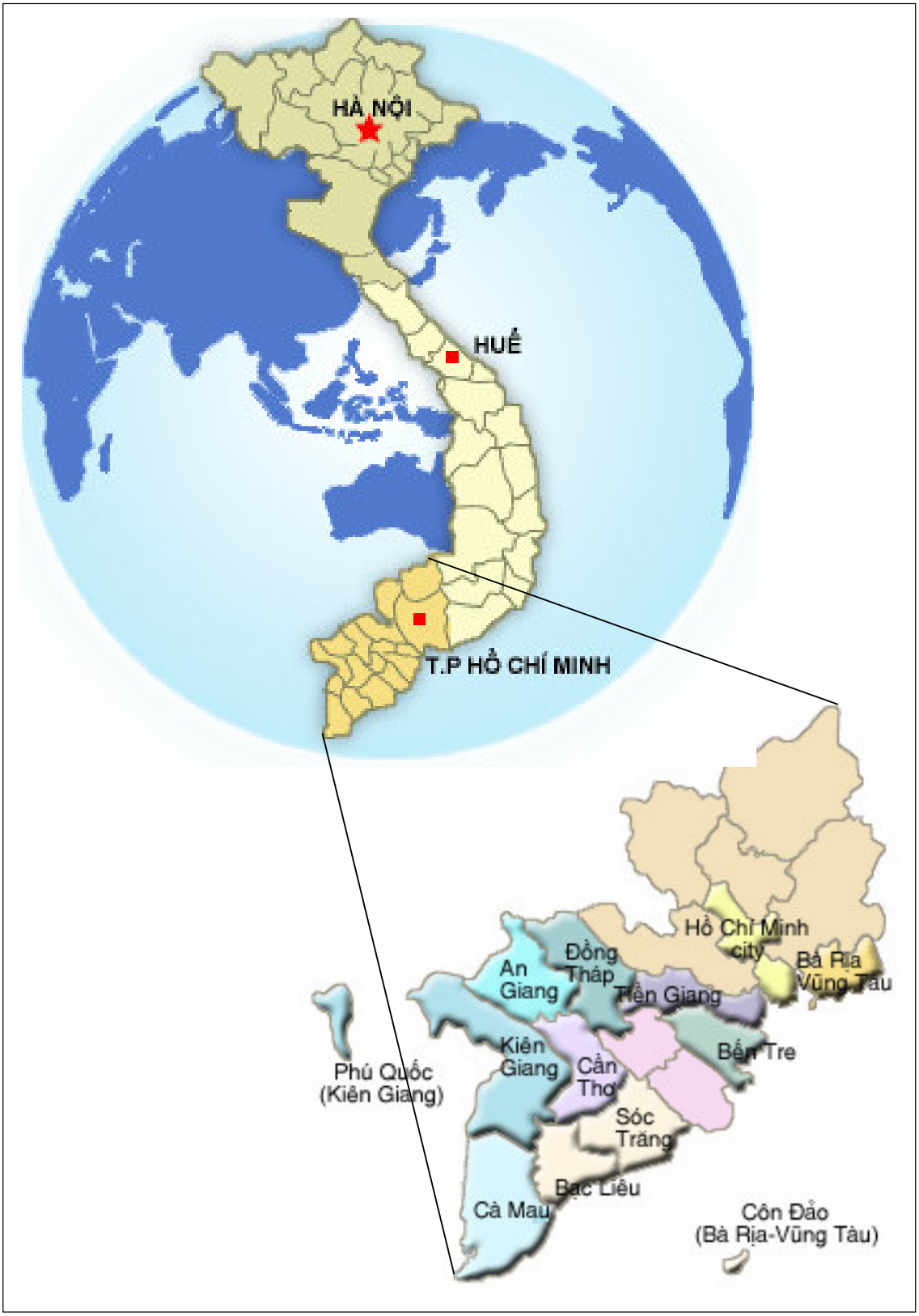


Figure 1.1 Maps of Vietnam and the South of Vietnam

export turnover. The NAFIQAVED is the unique representative of Vietnam's Industry of Fishery in the role of seafood products inspection before export.

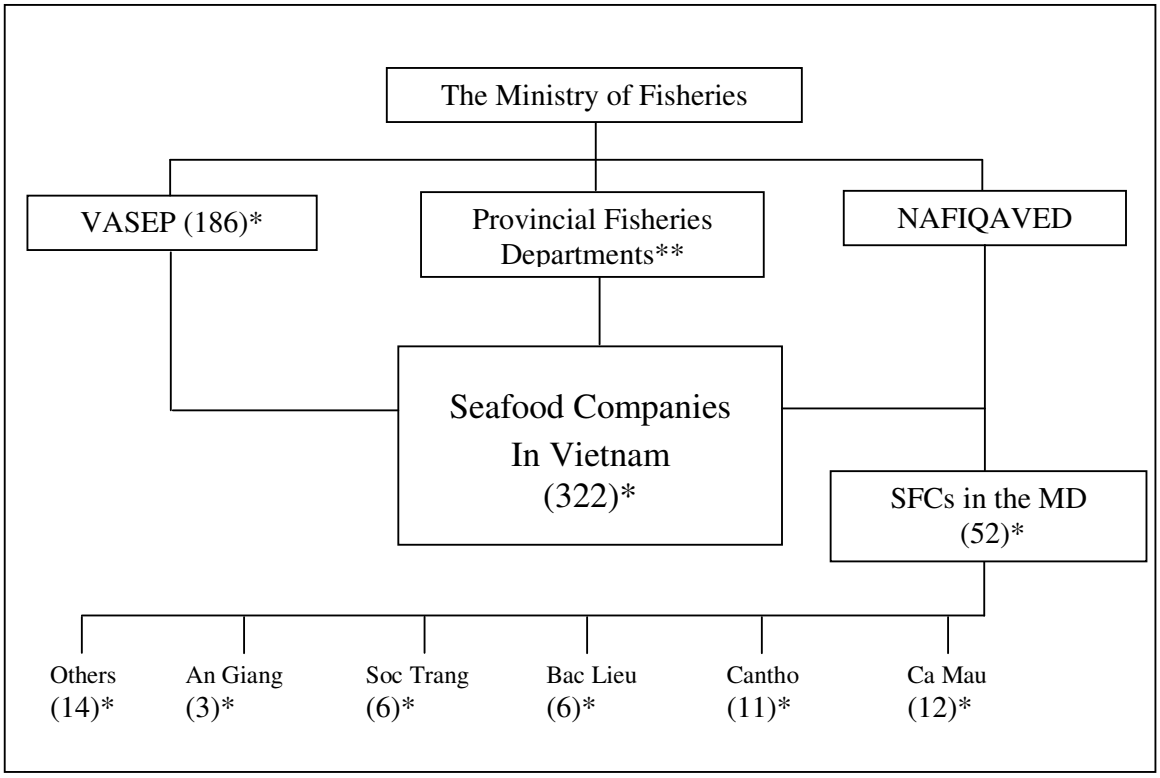


Figure 1.2 The structure of Vietnam's SFC organization
(* the number of SFCs; **explained end of this section)

So far, the VASEP is concerned with two supporting activities: trade and regulation. The trade supporting activity relates to shrimp processing and export. More specifically, the VASEP has provided consultancy services to its members, such as market information (on competitive products, prices, customer requirements, and markets), issues of technological information and science, marketing, business administration, quality control training, and legal matters. In addition, the VASEP has acted as a common voice in negotiating or resolving export issues in the Vietnamese fishery markets in general and in shrimp products in particular, such as anti-dumping of Basa fish and shrimp on the US markets. The regulatory role of the VASEP concerns making suggestions to the Ministry of Fisheries on fishery safety policies, rules and regulations as well as on the protection of fishery resources. VASEP gets feedback from its members at a meeting that is organized once a year.

In contrast to the VASEP, the main focus of NAFIQAVED is on regulation. Within this framework, it implements national and international policies on fish

quality, safety, hygiene, and veterinary matters – from primary production through distribution – with the aim of keeping products free of diseases; ensuring fish hygiene, safety and quality control; and protecting consumer health. The main objective of NAFIQAVED is fishery quality management, hygiene and safety. NAFIQAVED inspects SFC seafood products before they are exported to ensure that the products will be approved by importing countries such as the European Union (EU), the US, and Japan. NAFIQAVED has six branches that are located in the main areas of fishery development from the north to the south of the nation, namely Hai Phong, Da Nang, Khanh Hoa, Ho Chi Minh City, Cantho, and Camau. These branches are responsible for both shrimp processing quality control management and shrimp culture management. More specifically, by providing training in quality control and taking samples of the water environment monthly they help the SFCs to test for any hazards in raw materials and final seafood products before they are exported, and they also issue rules and make policies and regulations that are related to fishery hygiene and safety in general and shrimp in particular. State management regulations created in this way are implemented directly to provincial fisheries departments, such as the Department of Fisheries (DF), the Extension Centre (EC), the Department of Fisheries Resource Development and Protection (FRDP), the Department of Science & Technology (DST), and the Institute of Fisheries Research. In addition, NAFIQAVED performs quality control and inspections, and ensures environmental protection while at the same time receiving feedback from other departments and local governments to adjust or make new regulations.

1.2.2 Problems relating to the quality and safety of Vietnam's seafood products

Each week, export markets of the EU, US and Japan publish warnings on the basis of results from testing Vietnamese seafood products. The warnings may refer to infection levels of antibiotics, microbiology, and other contaminants. These infections can occur in the entire chain due to low quality raw materials as well as to low hygiene and safety levels during culture, maintenance, transportation, processing, storage, and distribution. According to the National Fisheries Inspection and Quality Assurance (NAFIQACEN; renamed NAFIQAVED since August 5, 2003) in 2002 approximately 9.4% of the tested output did not meet the standards for export in terms of safety, hygiene and quality. Specifically, Mr. Cuong, director of the NAFIQAVED, said that almost all SFCs had applied the HACCP program but not fully. As a result, many seafood containers, especially shrimps from Vietnam, were destroyed or sent back. Moreover, according to US-based OASIS (Organization for the Advancement of Structured Information Standards), several seafood containers from Vietnam were infected with salmonella in October 2002. In addition, there

were other issues related to quality control in this market such as incorrect labelling and antibiotic residues (VASEP website).

There are many issues that are related to quality, such as out-of-date machinery and equipment for catching and storing raw materials offshore, the unskilled workforce, polluted fields, uncontrolled seed, lack of knowledge in regard to the use of antibiotics, pesticides and other chemicals. These issues lead to a low quality of raw materials, of which shrimp is a typical product. As far as seafood processing is concerned, at present (i.e. 2002) nearly 80% of the seafood processing facilities in Vietnam (60% of the total SFCs) is more than ten years old, therefore they can barely meet the quality that is demanded for export. Accordingly, value-added products only account for 15% of the total value of exports. Most of Vietnam's exported seafood is a raw product – refrigerated or frozen. And finally, quality standards, such as GMP, SSOP, SQF, BRC and especially HACCP, have not yet been sufficiently applied by the SFCs (Loc, 2002).

To understand the nature of seafood problems in Vietnam, in his/her research Thanh Thu has made a start with "The measures for Vietnam seafood export markets" at 94 SFCs in Ho Chi Minh City (HCMC, 2001). The main problems related to the export markets of the SFCs can be stated as:

- The very strict market standards on seafood safety and hygiene;
- The lack of market information;
- Weak marketing;
- High transportation costs;
- Low prices for exports;
- A lack of clean raw materials;
- Little/Few valued-added products;
- High manufacturing costs;
- Strong competition; and
- High import taxes.

In general, the main problem for the companies in HCMC is that their products are barred by barriers of seafood safety and hygiene from certain markets, such as the US, EU, Japan, Canada, and Australia. A SWOT analysis (Bobette Kyle, 2000) of the main seafood export markets of Vietnam leads to the following overview.

- **Export to the US market by SFCs**

Strengths (S)	**Opportunities (O)**
1. High growth rate of export value and volume 2. Fast development of aquaculture 3. 75 SFCs applied HACCP 4. Diversification of Vietnam's seafood	1. Reduced tax for some seafood products after Vietnam-US trade agreement 2. High consumption
Weaknesses (W)	**Threats (T)**
1. Lack of US market information 2. Backward processing technology 3. Raw products with low price 4. Unstable raw materials	1. Strong competition by products from Thailand and Canada 2. Strict quality control

- **Export to the EU market by SFCs**

Strengths (S)	**Opportunities (O)**
1. More SFCs code certified by EU market 2. High product quality 3. Diversification of Vietnam's seafood	1. High potential need for aquaproducts 2. Beef and mutton crisis in EU
Weaknesses (W)	**Threats (T)**
1. Raw products with low price 2. Low growth rate of export volume and value 3. Backward processing technology 4. Passive behavior vis-a-vis market information 5. Unstable raw materials 6. Weak marketing	1. Strong competition by products from Thailand, India, and Bangladesh 2. Very strict quality control (zero-tolerance) 3. EU concessionary to other poor countries

- **Export to the Japanese market by SFCs**

Strengths (S)	**Opportunities (O)**
1. Vietnam's largest seafood export market 2. Top reputation for Vietnamese seafood quality in the Japanese market.	1. Lower import tax than competitors 2. Good cooperation in production and trade
Weaknesses (W)	**Threats (T)**
1. Low export value (raw products) 2. Weak marketing 3. Lack of consumer information	1. Lack of a differential trade mark 2. Weak competition by products from India and Thailand 3. Strong competition among Vietnam SFCs

It should be noted that the above mentioned seafood problems do not concern the SFCs in the HCMC only; they concern all SFCs in Vietnam when exporting seafood products to those markets.

1.3 Shrimp quality control problems in the MD

1.3.1 Introduction

(see B3 of Appendix 5 for details)

The MD is a vital agricultural zone for the nation. With a tropical monsoon climate and favourable weather conditions, it lends itself very well to the growth of rice and a wide range of plants and vegetables all year round. Coastal seafood is the most important component of aquaculture in the MD. In addition, agriculture, including aquaculture, plays an essential role in the lives of farm households in the region. New strategies for economic development by the government have encouraged the development of agriculture for the growing economy. Moreover, the region is also known for its lowland and wetland biodiversity with the Melaleuca forest ecosystem in the freshwater areas and the mangrove ecosystems at the coast. Thus, the region has good natural conditions for aquaculture development. The annual growth rate for aquaculture in the MD has been estimated at more than 10% compared to about 6% for the entire country. Aquaculture in the MD, therefore, is considered a huge potential for future aquaculture development (Ministry of Fisheries, 1995 & 2000).

In recent years, the decline in the cultivation of rice and the increase in the role of aquaculture represent an important structural change of the economy in the rural areas of the region. More consideration and support are expected to lead to the development of small-scale aquaculture (Ministry of Fisheries, 1996 & 2000). In fact, there are 954,356 hectares of inland bodies of water, of which 344,320 hectares concern fresh water, excluding river areas. It has been estimated that about 50.3% of the total bodies of water is suitable for aquaculture. Shrimp culture farming is now especially popular in the MD. Traditional shrimp cultivation has been conducted in this region for years, but shrimp cultivation began to develop rapidly at the end of the 1980s – which was later than in neighbouring countries such as Thailand, the Philippines, and Indonesia. The MD region contributed over 50% of the total aquatic volume and 60% of exported aquatic value of the nation. It contributed between 75-80% in terms of shrimp culture areas and 85-90% in terms of production output during 2000-2003. In 2002 the MD's shrimp export value accounted for 89% of the total exported shrimp value of the nation (Ministry of Fisheries, 2003). Ca Mau, the most southern province of Vietnam, is the leading province in terms of area of cultivation and in production output.

However, the rapid and spontaneous development of shrimp culture has led to technical and environmental problems, and it has created some important socioeconomic issues. Many of these issues stem from serious shrimp disease outbreaks in the MD since the end of 1993. These have affected the quantity, quality and grading (size) of shrimp, which determine the export volume and value to global markets both in the short and in the long term.

In addition, in recent years most of the MD companies did not have the conditions and effective methods to control product quality in their supply chain. As a result, their seafood products in general and shrimp products in particular have been contaminated by antibiotics, microbiological elements, and other contaminants. This has led to the refusal or even destruction of products by countries and regions with strict import market standards, such as the EU, US, and Japan. These markets demand that exporters of seafood products assure hygiene and safety for consumers. Contamination may have occurred anywhere in the supply chain: during primary production, transportation, processing, warehousing, inventory facilities, technology, packaging, or distribution (Loc, 2002).

As of 2002, in the MD there were 87 SFCs (41 SOEs, 14 corporations, 28 private companies, 1 joint-venture company and 3 foreign companies) located in twelve provinces, of which 52 SFCs had been in business over a year, while only 32 SFCs export shrimp and other sea products. Also in 2002, seven of the ten leading export SFCs were located in the MD. Together, they achieved an export value of US$638.433 million (i.e. 31.56% of Vietnam's total seafood export value – Table 1.1). These SFCs still account for the majority of the export value of sea products, especially with respect to shrimp products in 2003 and 2004 (32.5% and 34.2% of Vietnam's total seafood export value, respectively).

Table 1.1 Top ten export SFCs in 2002

No.	Name of SFC	Exported volume (tons)	Exported value (US$ million)
1	*Kim Anh Ltd.	9,114	102.160
2	*Minh Phu Ltd.	8,770	100.160
3	*Fimex Vietnam Co.	7,093	77.618
4	*Camimex Co.	7,801	73.167
5	*Cafatex Co.	7,500	62.000
6	Cofidex Co.	6,420	58.055
7	*Seaprodex Minh Hai Co.	4,500	45.500
8	*Kisimex Co.	31,312	45.000
9	Seaprodex Da Nang Co.	5,200	37.540
10	HCMC Fisheries Trading Co.	10,250	37.025

Source: www.vneconomy.com, Vietnam Economic Times 25/6/2002
Note: (*) SFCs from the MD

1.3.2 Shrimp quality control problems in the MD

1.3.2.1 Results of exploratory interviews

On the basis of the exploratory interviews with ten SFCs in the MD (3 in Bac Lieu, 2 in Ca Mau, 2 in Soc Trang, 1 in Tien Giang and 2 in Cantho), we learned that the following factors affected shrimp product quality throughout the chain, according to the leaders of the SFCs.

Table 1.2 Factors affecting shrimp product quality

Factors	% of the answers
(1) Quality of input shrimp material	90
(2) Purchasing process	80
(3) Storage process	80
(4) Transportation process	80
(5) Processing technology	70
(6) Processing techniques	80
(7) Distribution process	60
(8) Market information	60

Source: interview results (Loc, 2002)

Most of interviewed companies agreed that the quality of shrimp material is the most important factor in relation to finished shrimp quality. The shrimp quality can be affected by antibiotics (cloramphenicol, nitrofuran), microbiology (salmonella), and metal pieces. These problems lead to (i) very high extra costs (e.g. the extra costs of a company: US$1/kg/day for the distribution process or US$1,000/night for the storage process); (ii) loosing customers (e.g. decline in customers from the EU, Japan and US in recent years); (iii) loss of trademark and reputation by Vietnam's seafood products, etc.

Moreover, measures to improve product quality of the SFCs have been limited due to (1) the high cost of fully implementing HACCP and other relevant quality standards; (2) the limited understanding of workers as to what the meaning of HACCP and relevant quality standards is, resulting in incomplete adoption of the process; (3) ineffective activity by the quality control team; (4) a lack of capital to improve the various technologies or asynchronous investment.

Approximately 17% of total SFCs are large-scale in terms of capital and employees in the region (more than 1,500 employees per company). They can control the quality of their raw shrimp by investing more in education of farmers. To do so, officers from the companies, along with technicians at local extension centres and/or researchers from university, show farmers how to produce safe products. Their presence also helps farmers to prevent hazards from production through to the sale of their products. However, the companies

have not yet eliminated hazards completely from their products, because they lack the modern equipment to recognize those hazards. Moreover, because most of the SFCs in the region are small- to medium-sized, they lack both capital and equipment for farm investment. Figure 1.3 shows the SFCs supply chain quality management revealed by the interviews in the MD.

- Supplier 1 includes farmers who both cultivate and catch shrimp. Supplier 2 refers to wholesale buyers and collectors who buy raw shrimp directly from supplier 1. Most of the shrimp materials are distributed through this channel (over 60% of the total shrimp production). Specifically, the collectors buy shrimp materials from the farmers and sell them to their wholesale buyers. Supplier 1, who cultivates shrimp, may supply raw shrimp directly to the SFCs if the farm is located near a company or if a company has invested in the farm. Those companies that have suitable conditions for increasing their production capacity extend their investment in farming to assure a steady supply of high quality raw shrimp.
- Supplier 2 sells shrimp materials to the SFCs.
- Almost all SFCs in the MD export their finished product directly to foreign import companies or foreign distributors; Those agency distributors then relabel and re-export the products to other distributors or retailers, and finally to end consumers.

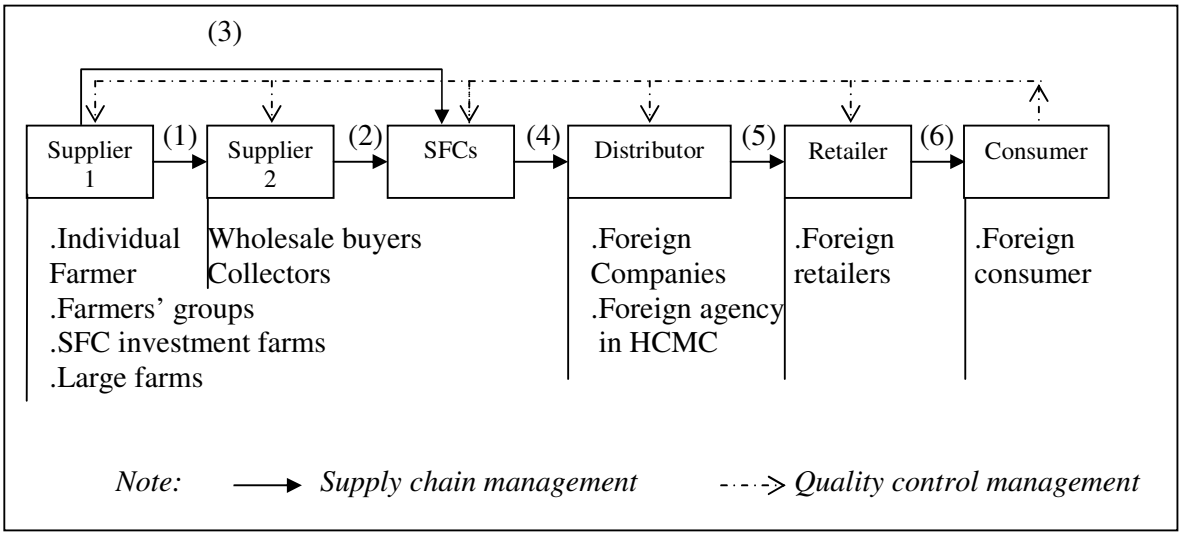


Figure 1.3 The supply chain quality management of interviewed SFCs

On the supply side there are many quality problems, such as not purchasing good quality products at the right time, and fluctuations in the price of raw shrimp frequently due to strong competition among the SFCs in the region and in HCMC or in other regions because of supply uncertainties, i.e. seasonal

supply, grading standards, shrimp maintenance, storage, transportation, classification of shrimp material, cheating by farmers, etc.

There are some other chains that are in the same situation as the shrimp chain in the MD, like fish and meat. These chains may be useful cases and a good reference for solving chain problems. For instance, when comparing the fish chain in the MD, there are not so many differences with the fish chain in the Netherlands. Vietnam's exported fish products come from farmed fish and caught fish. Framers or collectors then sell the fish to the companies. The only difference is that an auction system for buying/selling raw aquatic products has not yet been developed in Vietnam. As far as the shrimp chain is concerned, there are some differences, which will be described in detail in the next section.

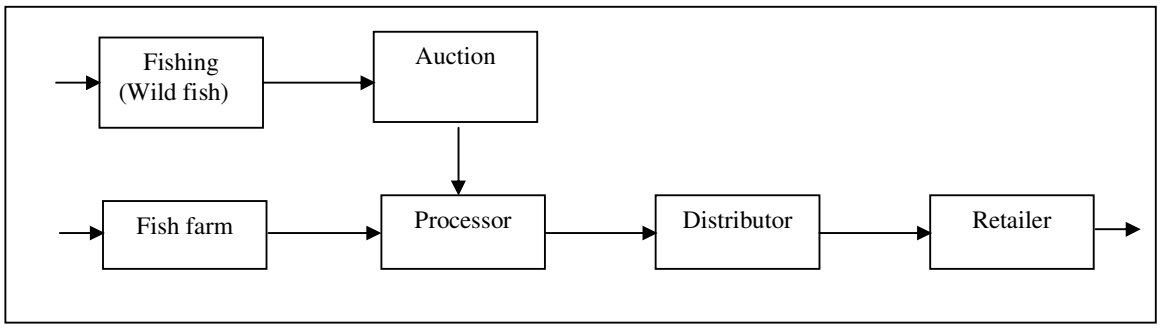


Figure 1.4 The fish chain in the Netherlands

In short, the quality of Vietnam's seafood products in general and shrimp products in particular nowadays is of great concern to importers. The barriers stemming from seafood safety and hygiene regulations are very high. The products have to be free from antibiotics (chloramphenicol, nitrofuran), microbiology (salmonella), and other contaminants such as metal pieces. Therefore, the production of high-quality seafood products in order to meet international quality standards (ISO, HACCP, GMP, SSOP, SQF and BRC) today is an urgent task for the Fisheries Industry in general and the SFCs in particular.

1.3.2.2 Shrimp supply chain quality control problems in the MD

The following figure describes the shrimp supply chain and its quality problems in more detail.

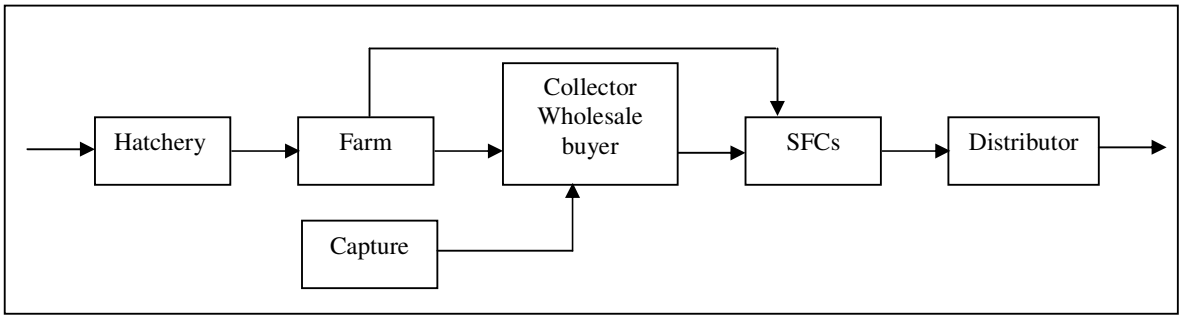


Figure 1.5 The shrimp chain in the MD

Marine catch (capture)

After raw shrimps have been caught, they are stored on a boat offshore. The average time that they are kept offshore is 5 to 7 days (minimum 3 days, maximum 15 days). The raw shrimps are then sold to the collectors/wholesale buyers who within a day sell them on to the SFCs. In general, shrimp is seldom infected by micro-organisms and antibiotics after catching. However, they can still become infected during storage, before they are bought onshore. The factors that may affect the original quality of raw shrimp are methods and techniques to maintain raw materials offshore as well as storage means during transportation.

Aquaculture

One of the factors affecting shrimp quality is the quality of shrimp seed at the hatchery. The following figure illustrates the life cycle of shrimp, from shrimp eggs in the hatchery, to farmers for culture and then to companies for processing and distribution.

There are many factors that affect shrimp quality in primary production.

- ***Shrimp seed***

  - *At the hatchery:* Eggs become nauplius within 12-14 hours. They become protozoa, mysis and postlarvae next, and they grow to a size of 2.0-2.5 cm.

  - *At the farm:* The farmers buy shrimp seed with a size of 2.0-2.5 cm from the hatchery. The average time from buying to harvesting is four months. There is one main shrimp crop per year, starting in January and finishing in May. With intensive methods, harvesting can continue for some months beyond May, because shrimps are cultured several times during the season and they are harvested many times. After harvesting, the shrimps are bought by the collector/wholesale buyer or by the SFCs

directly. The collector/wholesale buyer keeps raw shrimp 1-3 days and then sells to the companies.

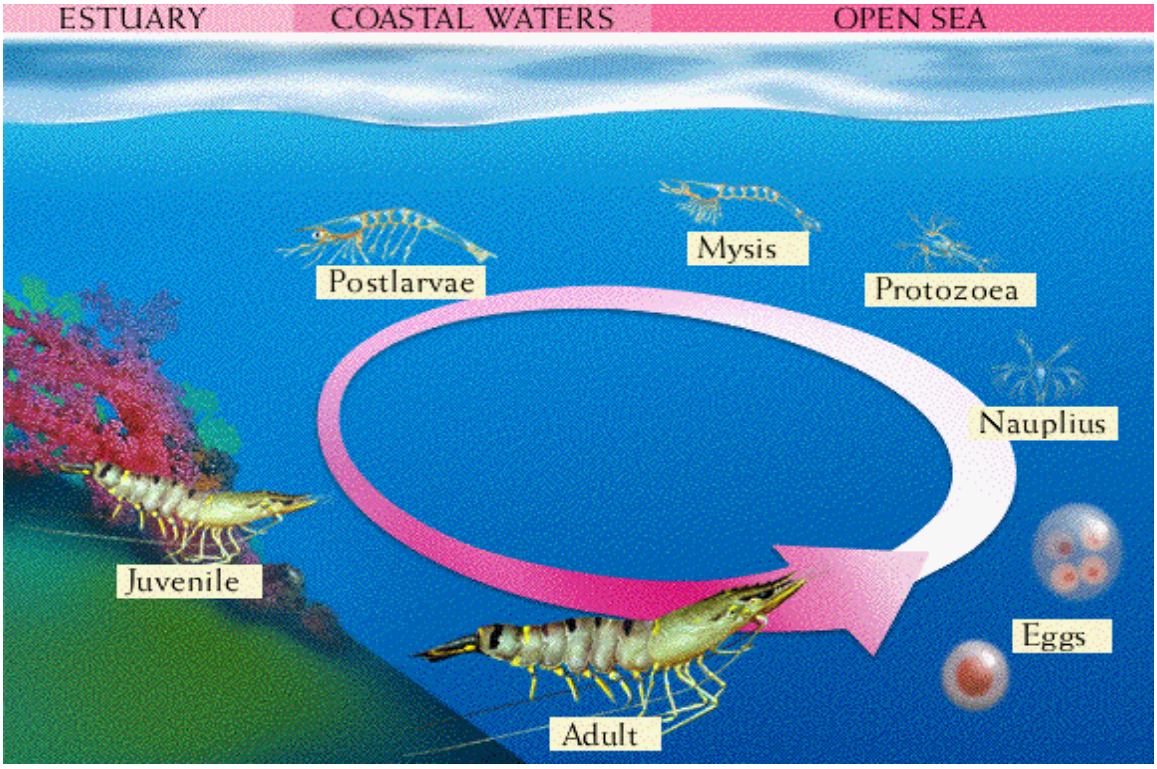


Figure 1.6 The life cycle of the black tiger shrimp

In the MD, in 2002 there were about 900 hatcheries (19% of the total hatcheries in Vietnam), which provided 3,877 million postlarvae (accounting for 18.9% of the total demand for postlarvae in the MD and about 20% of the total of postlarvae produced in Vietnam). Postlarvae were imported from the central region to be nursed for several days at one of the 1,312 nursery sites around the coastal areas of the region before were resold to grow-out farmers. However, management of postlarvae quality and trading has not improved. There is a lack of high-tech monitoring methods and facilities for seed quality during transportation network (Ministry of Fisheries, 2000-2003). To be more specific, 40-45% of the total shrimp seed from free sources is not inspected or checked by any of the Vietnamese organizations or even inspected by use of the simplest of methods: visible perception. As a result, shrimp diseases are common (42.3%): fungal disease, white spot disease, and MBV disease (Penaeus Monodon-type Baculovirus disease). In order to prevent and

cure these diseases, farmers have used over 35 kinds of different antibiotics without any monitoring (Sinh, 2001).

According to Sinh's research results (2001) on the shrimp seed market, the quality control problems of shrimp seed in the hatchery include the following.

- *Pollution of water sources* is caused by the poor design and high density of the hatcheries, disease pathogens, culture systems without treatment from the hatcheries and grow-out ponds, and other polluting activities in the community.
- *Pathogen infection*: after shrimp disease outbreaks, most of the shrimp seed was infected by Penaeus monodon-type baculovirus (MBV), white spot disease (WSD), and yellow head disease (YHD). These diseases infected approximately 27.6% of the total number of shrimp grow-out farms in 2002.
- *Inappropriate application of chemicals and antibiotics*: a lack of appropriate government regulations and the farmers' poor understanding of the use of chemicals and antibiotics have led to an inappropriate use of antibiotics and chemicals. This may damage not only shrimp health and water quality, it can also increase the resistance of pathogens to antibiotics.
- *Cheating in the marketing of shrimp postlarvae* by shrimp seed producers and middlemen or nursery site owners has occurred due to strong competition concerning the supply of shrimp seed, and to a lack of information on the shrimp seed provided to the grow-out farmers. In addition, there are difficulties with respect to transporting shrimp seed.
- *Buy shrimp seed hurriedly without taking sufficient care* is the final reason. Because of the high demand for shrimp seed, many grow-out farmers try to buy shrimp seed as quickly as possible without really considering the size or quality of the shrimp. As a result, they breed shrimp that are difficult to grow that increase grade and weight difficultly, and that may even carry shrimp seed diseases.

- ***Culture techniques***

  Quality control problems in this respect may be caused by the following aspects.
  - The level of water pollution is very high in the MD due to environmental pollution and intensive cultivation.
  - The farmers spend a lot of money on shrimp seed (39.4% of the total costs), shrimp food (19.9%), and antibiotics to protect and cure shrimp diseases (4.2%).

- In the MD, shrimp feed is only delivered directly by retailers. Therefore, the ingredients in the feed have not been controlled by the authorities. In addition, some food ingredients for shrimp breeding contain certain banned antibiotics and various types of medicine for weight gain.
- Methods of quality control and management by farmers. Farmers lack managerial and quality control skills. This leads to the excessive use of feed and antibiotics. As a result, shrimp material is not absolutely clean and safe.
- Harvest time. In Vietnam food infection occurs frequently because farmers do not know when they should harvest their products with a view to food security after having used pesticides, chemicals, or medicine. In shrimp culture it is very important that farmers harvest on time in order to prevent pool pollution and infection.

Quality control problems related to shrimp processing

There are three main quality control problems in relation to manufacturing: lack of equipment and technology, quality management, and quality knowledge.

- Lack of quality control equipment to check shrimp material and finished product: Currently almost all SFCs in Vietnam lack the modern equipment to test shrimp input (from suppliers) and the finished shrimp product.
  - *Processing time*: The entire process – from receiving shrimp materials to the finished product (input-output process) – takes several days (the shorter, the better). A longer input-output process leads to a reduction in shrimp weight and quality.
  - *Processing technology*: Out-of-date technology creates long processing times and reduces product quality (changing shrimp colour and decreasing weight). Moreover, physical hazards are easily created when one uses very old technology.
  - *Simple processing techniques*: This is a very important stage in ensuring a high quality product. During processing, shrimp material is cleaned by hand and in a wet environment. Chemical hazards can occur easily during this process. Antibiotics used by workers to clean their hands in order to prevent fungal diseases may be transferred to the shrimp. Furthermore, unqualified workers produce low quality products.
  - *Inventory time:* a long inventory time leads to poor quality, i.e. change in colour, weight reduction, and poor taste. Chemical hazards (salmonella) can occur if conditions of facilities are bad.

- Lack of quality control information and the inadequate application of HACCP standards for food safety and hygiene by managers and workers: The SFC managers are the only ones that gave been trained in the

principles of quality management, such as HACCP, ISO, and SQF. Thus, their workers are unable to apply these measures effectively and efficiently in their own companies. As a result, there are quality gaps in the processing procedures that lead to a final product that does not meet quality standards. In addition, teaching quality standards to workers and applying them correctly is not easy because of the following reasons (focusing on HACCP standards):

- the high investment costs of introducing new technology;
- the lack of knowledge and methods to identify and describe the various hazards, lack of critical control points, lack of documents for observation, and not keeping records as well as inadequate starting procedures for eliminating the hazards;
- the lack of standard conditions in the manufacturing process in order to meet the requirements of GMP, SSOP, and BRC.
- lack of quality knowledge about SQF, ISO, and HACCP at the level of the middle managers and workers, as well as the lack of methods and principles to apply HACCP quality control standards, resulting in hazard infection in final shrimp products.

Market problems

Market problems affecting product quality include consumer information shortage, technical barriers, trademark, and contracts.

- Shortage of consumer information. Today, all consumers want their shrimp to be of the highest quality. These requirements and expectations are different for different markets (various types of product, weight, and size). Therefore, it is not always easy to respond quickly to the market and to meet customer needs when they change their consumption behaviour.
- Strict controls and testing by importers for micro-organisms and antibiotic residues in finished products. Japan, the US and EU now use modern technology and equipment to test for chloramphenicol, Nutrofuran, fluoroquinoles, and other antibiotics in seafood products with zero tolerance for quality deviations. This causes difficulties to SFCs who cannot change their quality standards to meet new technical restrictions in the short term.
- Strong competition and conflict of trademark. Vietnam's seafood products face stiff competition with those from Thailand, Ecuador, and Indonesia in terms of price and quality. For example, there is conflict with the so-called catfish trademark in the US market: Vietnam is not allowed to use the term "catfish" for the same product. In addition, very high import taxes on Vietnam's fish products (between 36.8% and 63.8%) as well as shrimp anti-dumping in the US market create a big challenge for Vietnam's seafood export to this market.

- Other problems regard contracts, such as exchange rates, transportation, and documents.

Managerial and technological problems in primary production
As mentioned above, the seafood supply chain problems are related to managerial and technological constraints. Lack of methods to manage and control high quality shrimp materials (capital investment to build culture infrastructure, techniques as well as training for farmers to create high quality shrimp material) leads to infection of shrimp material by various hazards. Other reasons of hazardous infection include the lack of modern technology, equipment as well as qualified staff to perform hazard tests at any level, e.g. at the Department of Fisheries, the Extension Centre, Fisheries Resource Development & Protection, and even at NAFIQAVED.

1.4 Research objective

The objective of this research is to develop a seafood supply chain quality management framework.

The main problems addressed in the research relate to shrimp supply chain quality management, and therefore it is expected that the framework will contribute to the development of effective solutions for these problems. The seafood supply chain stakeholders mentioned in the study comprise hatcheries, farms, collectors/wholesale buyers, SFCs, and distributors/agencies. Because quality problem with seafood in general and shrimp in particular can occur at all stages of the chain – from the hatchery to distribution – the development of the seafood supply chain quality management framework is crucial. Among the chain actors, the role of the SFC is vital – not only in ensuring the quality of the final product, but also in SFC's material suppliers. In order to control the quality of the supplier's product, the framework shows the necessity for supplier quality management and partnerships. At the company level, HACCP implementation is emphasized. At the distribution stage, measures regarding equipment and conditions for product storage and transportation are key issues. While the SFC does yet not check/monitor all quality problems in the entire chain, VASEP, NAFIQAVED and local departments of aquaculture play a key role as support organizations for chain quality and safety goals (see Step 4 for details).

1.5 Research structure, methods and methodology

The research implementation from "problem faced" to "problem solved" will be presented by an eight-step procedure structured throughout the seven chapters of

this study. The contents of each step will consist of step goals, activities, methods, and methodology.

1.5.1 Step 1 - Research background, structure and methodology

This step aims to provide an overview to the research in the field. Activities in this step provide a general description of common problems found in the world's food safety and quality control, as well as an overview of Vietnam's sea product problems in general and shrimp quality control problems in the Mekong Delta (MD) in particular. The activities were conducted by collecting secondary and primary data and general information. These data were collected from the fishery industry and other fishery related activities – throughout the world, in Vietnam and, more specifically, in the MD. Explorative and unstructured interviews were used to collect primary data and information. These interviews form the first empirical research element of the project. They can be used to get an overview of the problem. Step 1 results in a general description of what research, research problems, research objectives, research structure, methods and methodology, already mentioned in Chapter 1, are relevant and why.

1.5.2 Step 2 – Literature review

The aim of this step is to discover relevant theories, concepts and worldwide experience that can be applied to the research problems identified in Step 1 in the hope of finding solutions. The activities of Step 2 involve reviewing the theoretical bases that can be used to develop a supply chain quality management framework and an improvement process. Theoretical bases relate to food quality management; the combination of quality management and supply chain management; quality assurance and improvement in the food industry; and the role of government and industry in food safety assurance. Specifically, theories and experiences regarding the role of the HACCP system implementation in developing countries for ensuring food safety will be stressed. The step will help us understand in detail the HACCP system; the importance of HACCP and other prerequisite programs; the role of HACCP in international trade; the current implementation of HACCP in the world; and food safety constraints and problems in relation to HACCP in developing countries. Because quality problems in this research relate to chain managerial aspects as well as to technological aspects, a techno-managerial approach to food safety and quality management is applied. This approach – discussed by P.A. Luning, W.J. Marcelis, and W.M.F. Jongen (2002) – encompasses the integration of both technological and managerial aspects. Quality problems are considered interactively from both a technological and managerial viewpoint. A good example of techno-managerial thinking is the HACCP system, wherein critical hazards are controlled (Chapter 2).

1.5.3 Step 3 – Company survey

This step aims to gather more data and general information in order to develop the seafood supply chain quality management framework. Activities in this step include determining what data and information are needed; where they are to be collected; and how to collect them. Both primary and secondary data were needed.

Primary data were collected at 32 SFCs in the MD, including chain information. Secondary data come from different sources, such as VASEP, NAFIQAVED, local fishery departments, and also from the SFC reports. The methods used to collect data and information are interviews and exploratory and descriptive surveys. The survey implementation aims to gather and analyze data in order to identify where in the chain quality issues occurred, what was the cause of the problems, and who was involved. This company survey is the second empirical research element in the project. The survey gives an insight into the background of the problems. The problems show what improvements should be made. The final result of this step will be described in detail in Chapter 3.

1.5.4 Step 4 – Development of a supply chain quality management framework

This step is conceptual. The principle goal of this step is to develop the seafood supply chain quality management framework including measures to control seafood quality and safety within the SFC and within the chain. In other words, the framework focuses mainly on SFC activities and chain activities for seafood quality and safety. The framework is presented in Chapter 4.

Within the framework, quality solutions at company level (intra-SFC part of the framework) will stress measures to improve quality control management. Improvement of the HACCP system is the crucial factor here. Improvement aspects related to the HACCP system will focus on technological and managerial issues, as well as on organizational behaviour with respect to quality control. These issues have emerged as main problems affecting seafood quality and safety – consisting of e.g. the lack of testing equipment, backward processing technology, limited storage, transportation conditions, and insufficient management of processing techniques. Implementation of this part of the framework will help the SFC to identify specific quality gaps and deficiencies, and it will help to determine the quality improvement that is necessary (the diagnosis phase).

The chain part of the framework relates to the primary production. Chain factors comprise all chain actors (farmer, collector, wholesale buyer, feed wholesaler, SFC, NAFIQAVED branches, VASEP, EC, and DF) and affect managerial issues of seafood quality and safety in primary production (Figure 6.2).

1.5.5 Step 5 – Testing the framework at the SFCs

The objective of this step is to test the intra-SFC part of the framework. The implementation of HACCP is stressed here. In this study, due to restrictions of time and budget only two SFCs will be tested for an in-depth insight into shrimp quality and safety in the supply chain. These two case-studies form the third empirical research element in the project.

According to Yin (1994), case study research is particularly suitable for studying a phenomenon in its real-life context. Conducting case study research should ensure reliability and validity. By studying the development of the quality management improvement framework through case studies, actual practice can be seen. As a result, an understanding of the actual phenomenon and relevant theory can be generated. In addition, case study research is specifically suitable for answering questions of how and why (Meredith, 1998; Yin, 1994). According to Meredith (1998), "how" questions relate to explanation or prediction, and "why" questions to understanding the phenomenon. Various academics argue that case study research is especially suitable for theory building (Voss, Tsikriktsis & Frohlich, 2002; Meredith, 1998). The emphasis on case study research in understanding the phenomenon studied focuses on theory building (Meredith, 1998). Handfield and Melnyk (1998) mention that the purpose of case study research used for theory building is to identify key variables, linkages between variables, and to identify *why* these relationships exist. For the above reasons, two different kinds of SFCs in the MD will be chosen: a state-owned and a joint-stock company.

The contents of HACCP test implementation include issues regarding GMP/SSOP prerequisite programs, storage and transportation conditions, and twelve-step HACCP procedures and principles. In addition, general information for the two test companies and their chains is also collected. This information includes the company characteristics, managerial structure, supplier quality management, quality control system, technological investment, and information from support organizations. Finally, the explanation and discussion of test results will provide an in-depth insight into the SFC problems with respect to shrimp quality and safety (Chapter 5).

1.5.6 Step 6 – The intra-SFC quality improvement measures

This step describes the intra-SFC quality improvement process. The process includes nine steps aiming to close the quality gaps and deficiencies in SFCs for further seafood quality improvement. In the process, any plan for the quality improvement objectives will be monitored by the PDCA tool in order to improve company performance in general and HACCP implementation in particular. Using this tool, quality control improvement in the company will be a continuous process, described in Chapter 6, Section 6.2.

1.5.7 Step 7 – The chain quality improvement measures

This step focuses on exploring the possibilities to improve quality at the chain level. To achieve this goal, 34 chain actors in the MD will be interviewed (Appendix 8). The interviews are structured on the basis of the framework formulated in Chapter 4. The opinions of actors and experts form the foundation for the formulation of chain improvement measures. This is the fourth empirical research element in the project. The results are presented in Chapter 6, Section 6.3.

1.5.8 Step 8 - Research conclusions and recommendations

The goal of this step is to summarize the seven chapters and the main research products, and to give further recommendations for quality improvement and research on quality improvement. The main research products include the literature, the SFCs' survey results, the seafood supply chain quality management framework, the SFCs' test results, and the results of the interviews with the chain actors. Step 8 also presents recommendations for further quality improvement of the SFC seafood in the supply chain and for further research.

1.6 Summary

This chapter deals with (1) global trends in food safety and quality assurance, especially HACCP system in the food industry, (2) Vietnam's sea product situation, and (3) shrimp supply chain quality management in the MD. It also presents the problems studied in the research, the research objective, the research structure, methods and methodology.

Four methods and methodology are used to perform the study. First, the collected secondary data and the exploratory interviews were used to identify the general research problems. Second, the official survey of 32 SFCs in the MD was implemented. The survey implementation aims to describe the seafood in general and shrimp chain quality problems in particular – from primary production to distribution. Third, case studies are used to test the seafood supply chain quality management framework (including solutions to cover the research problems). The test results are the basis for developing a chain quality improvement plan. The fourth method concerns quality measures in the chain (excluding SFC) that are based mainly on the additional interviews. It is noted that SFC is an element of the chain, so quality improvement measures do focus on SFC (intra-SFC quality improvement measures) and its chain (chain quality improvement measures). The next chapter will provide a theoretical basis for developing the research solutions.

Chapter 2

Literature Review

2.1 Introduction

Global consumers nowadays are more concerned about the safety of their food because of a series of food scandals and incidents that have occurred over the last decade and that see no signs of decreasing. The solution they call for is high food quality and integrity, safety guarantees and transparency. Governments are imposing new legislation; retailers are making new demands on their supply chains. Food supply chains are reacting by implementing systems to improve their product quality in an attempt not only to guarantee the safety of the products, but also to raise the consumer community's awareness of their efforts. Such efforts are performed at the level of either an individual company or a complete supply chain network (Van Dorp, 2004; Beulens et al., 2005). Food safety (FS), therefore, is currently considered to be an important issue for all stakeholders in the area of food production as well as governments in setting new legislation regarding FS.

Quality control has become a cornerstone of food safety policy over the past decade in the food industry. Much of the focus has been on integral quality management systems. These systems include all steps in the food production chain, such as supply of raw materials, food manufacturing, packaging, transportation and logistics, research and development, maintenance of production equipment, and training and education of staff. Moreover, "Food quality is associated with a proactive policy and the creation of controls to maintain a safe food supply. The business community in the food supply chain regards the call for safety from their customers, consumers, government and other stakeholders as an important driving force for continuous innovation. These innovations have been focused on implementing systems to improve the product's quality, to guarantee its safety as well as to raise awareness of these innovations throughout their supply chain stakeholders." (Folstar, 2001)

One of the important tools used to ensure food safety against hazard infections is the HACCP system. According to Sperber (2005), HACCP was begun as a voluntary science-based system within the food industry and it helps provide greater transparency in the food supply chain. The application of HACCP systems is a means of assuring proper food handling, processing and retail sale to consumers. The use of HACCP systems in the fishery industry is now global. Since it first emerged, the concept has increased in importance through its endorsement by Codex Alimentarius at the international level and by the EU and the US, two of the most important seafood importers. Currently, over forty countries have announced HACCP initiatives for the control of fish production, processing and distribution.

Although quality control in general and HACCP in particular have been used in manufacturing industries for decades, they are clearly ineffective and almost totally incapable of detecting food safety defects that occur at a low incidence (ICMSF, 2002). Coming out with detailed proof of this is Sperber (2005), who reports that the global use and success of the HACCP system in the food processing industry has created a false expectation that it could be used successfully in all steps of the food supply chain. However, this is not necessarily true. There has been a lack of defining of critical control points (CCPs), which have the function of eliminating or controlling identified hazards. As a result, there is no effective use of HACCP in all steps of the supply chain. In order to ensure food safety in the supply chain, it is necessary to combine prerequisite programs along with HACCP, rather than only CCPs taken from an HACCP system.

In other words, in order to ensure food chain supply safety, a combination of HACCP implementation and other prerequisite programs is vital throughout the chain. The reasons for such an emphasis (Billy, 2002; Motarjemi & Mortimore, 2005) lie in the fact that the food industry is today not only responsible for ensuring the safety of food production through various measures aimed at safeguarding against its hazards (i.e., the hazards which have been considered in production and the measures put in place to ensure the safety of products), but it is also responsible for the development of further HACCP studies as a part of the food safety assurance system. Thus, the HACCP tool and prerequisite programs play an important role in supply chain FS from “farm to table,” especially in both raw and ready-to-eat food products. In addition, the implementation level of HACCP and other prerequisite programs is different from country to country according to each country’s own conditions. But to achieve FS objectives and promote international trade effectively and efficiently, the role of government and industry is crucial in terms of setting performance quality standards, regulatory issues, implementation of inspection and audit as well as risk assessment throughout the whole chain.

Generally, the greatest constraints on the implementation of HACCP and prerequisite programs in developing countries are the limitations of managerial knowledge and technological investment within the food companies. These limitations are especially big challenges for SFCs in Vietnam in general, and in the MD in particular, in the effort to ensure supply chain seafood safety. Therefore, food quality control through the techno-managerial approach in the food chain is a useful approach used to solve the research problem in this study.

To conclude, the literature to review here has to do with not only the role of HACCP itself in food safety assurance, as well as the combination of HACCP and other prerequisite programs, but also the role of governments and industries, the techno-managerial approach, and the food supply chain quality and quality management in developing countries.

2.2 The role of HACCP in ensuring food safety

2.2.1 The HACCP system

The grounds for the development of the HACCP system stem from the pathway to the HACCP system started in 1959 when Pillsbury was asked to produce a food that could be used under zero gravity conditions in space capsules – food products for space use should not be contaminated with any bacterial or viral pathogens, toxins, chemicals or any physical hazards that could cause an illness or injury. At that time, most food safety and quality systems were based on end-product testing, but it was realized that this could only assure product safety through testing 100% of the products which, for obvious reasons, was not workable, since it would result in all products being used up. Instead a preventive system was required which would give a high level of food safety assurance. However, the implementation of HACCP approach is not easy to apply completely in the entire chain, particularly during primary production. As a result, importing countries are still rejecting products due to infection hazards.

What follows are summaries of the definitions and content of HACCP, HACCP principles and procedures, and the legal impact of HACCP.

2.2.1.1 HACCP definitions and contents

HACCP is defined by many authors. Some definitions refer directly to food safety, reflecting the predominant use to date of the HACCP approach in the food sector. Other definitions are more generic: a step-by-step approach to the identification and assessment of hazards and risks associated with the manufacture, distribution, and use of products. For instance, HACCP is defined as a systematic approach to the identification, assessment and control of hazards (McDonough, 2002). It is widely accepted as being the most effective means of ensuring food safety because HACCP is a management tool used to protect the

food supply against microbiological, chemical and physical hazards. In other words, HACCP is a system for identifying, evaluating and controlling the hazards in food manufacturing, which are crucial for product safety. It is also an analytical tool that enables management to introduce and maintain a cost-effective, ongoing food safety program. Peirson (1995) stresses that HACCP has been strongly suggested as an effective approach to prevent food safety hazards by many national and international scientific groups, corporations, government agencies and academic organizations.

In other words, HACCP is a proven system, which if properly applied will give confidence that food safety is being managed effectively. And HACCP is also a preventive system in quality control. The system when properly applied can be used to control any area or point in the food system that can contribute to the hazardous situation, whether it be contaminants, pathogenic micro-organisms, physical objects, chemicals, raw materials, a process, directions for use by the consumer, or storage conditions. Similarly, as Lackova (2001) has it, the HACCP is a tool which can integrate all elements of production, storage, distribution, and the preparation of food. And the control points can be used as inescapable measures to provide hygienic standards and health safety. The basic objectives of the HACCP concept are to assure the production of safe food products by prevention instead of by quality inspection (Leaper, 1997; NACMCF, 1998). Furthermore, the HACCP is basically designed for application in all parts of agri-food production, ranging from growing, harvesting, processing, manufacturing, distribution, and merchandising to preparing food for consumption (NACMCF, 1998).

The concept “hazard” in the HACCP terminology is expressed in terms of a danger to food safety from a biological, chemical or physical point of view. The term “hazard” refers to any part of a production chain or a product that has the potential to cause a safety problem. Analysis is the identification and assessment of the seriousness and likelihood of occurrence of a hazard. A critical control point is a point, step, or procedure at which control can be exercised to prevent, eliminate, or minimize a hazard. In the HACCP system specific dangers are identified all along the lifetime of a food product and the measures to manage (or control) these dangers.

- *Biological hazards* can be further divided into three types: bacterial, viral, and parasitic (protozoa and worms). Brown (1995) mentions methods for Microbiological quality assurance. Especially HACCP system. Many HACCP programs are designed specifically around the microbiological hazards. Archer and Kvenberg et al. (2000) estimates that the incidence of foodborne illness ranges from 12.6 to 81 million cases per year with hazard costs of 1.9 to 8.4 billion dollars. HACCP programs address this food safety problem by assisting in the production of safe wholesome foods.

- *Chemical hazards*: Webster defines a hazard chemical as any substance used in or obtained by a chemical hazard process or processes. All food products are made up of chemicals, and all chemicals can be toxic at some dosage level. However, certain hazardous chemicals are not allowed in food and others have had allowable limits established. A summary of most of the chemical hazards in food has been drawn up (Bryan, 1984). The two types of chemical hazards in food are naturally occurring ones and added chemicals. Both may potentially cause chemical intoxications if excessive levels are present in hazardous food. For additional information, see Foodborne Diseases (Cliver, 1990). Many HACCP programs have been criticized for their relative neglect of chemical and physical hazards.
- *Physical hazards*, often described as extraneous matter or foreign objects, include any physical matter not normally found in food, which may cause illness (including psychological trauma) or injury to an individual (Corlett, 1991). The most often reported complaint concerning physical hazards is that foreign objects provide tangible evidence of hazard product deficiency. Regulatory action may be initiated when agencies find adulterated foods or foods that are manufactured, packed or held under conditions whereby they may have become contaminated and may be injurious to health.

The hazard analysis portion of HACCP involves a systematic study of the ingredients, the food product, conditions of processing, handling, storage, packaging, distribution, and consumer use. This analysis helps to identify the sensitive areas in the process flow that might contribute to a hazard. This information can then determine the CCPs in the system that have to be monitored. A CCP is any point in the chain of food production from raw materials to finished product where loss of control could result in an unacceptable food safety risk.

2.2.1.2 HACCP principles and procedures

Several articles have described HACCP principles and procedures for the development and implementation of an HACCP plan (ICMSF, 2002; European Commission, 1996; Early, 1997; Leaper, 1997; NACMCF, 1992, 1998; Buchenan, 1990; Bryan, 1990; Bjerklie, 1992). According to them, an HACCP plan is a written document based on the principles of HACCP and delineates the procedures to be followed. The HACCP consists of seven principles and is implemented in a 12-step procedure (see Appendix 6 for details), which outlines how to establish and implement an HACCP plan for the operation. The HACCP principles have international acceptance and details of this approach have been published by the Codex Almentarius Commission (1993, 1997) the European

Commission (1994), the National Advisory Committee on Microbiological Criteria for Foods, US (1992, 1998), and WHO (1996).

- Assembling an HACCP team
- Description of the product and its distribution
- Identification of intended use and consumers
- Development of process flow diagrams
- On-site verification of flow diagram
- A hazard analysis, which involves collecting and evaluating information on hazards associated with the food under consideration to decide the significant hazards to be addressed in the HACCP plan (Principle 1).
- Determination of critical control points (CCPs), which are steps where controls can be applied and are essential in order to prevent or eliminate or reduce a hazard to an acceptable level (Principle 2).
- Establishing critical limits, which are maximum/minimum values at which a biological, chemical, or physical parameter must be controlled at a CCP (Principle 3).
- Establishing monitoring procedures to assess whether a CCP is under control and to create an accurate record for future use in verification (Principle 4).
- Establishing corrective actions, in case there is a deviation from an established critical limit (Principle 5).
- Establishing verification procedures to verify that the HACCP system is working correctly (Principle 6).
- Establishing record-keeping and documentation procedures to document the HACCP system (Principle 7).

2.2.1.3 HACCP legal impacts

HACCP has been and is being mandated into law in many nations all over the world. The EU, for instance, has adopted HACCP through the Directive 93/43 since 1993 (Ziggers, 2000), and is preparing new policies, regulations and laws (Van Plaggenhoef, Batterink & Trienekens, 2003). In the US, HACCP was mandated for seafood in 1995, for meat and poultry in 1998, and for the juice industry in 2001 (FDA, 2001). The Australian Food Standard Code required HACCP-based food safety programs from January 2003 onwards (Food Standards Australia New Zealand, 2002). In New Zealand, the Animal Products Act 1999 required all primary animal product processing businesses to have an HACCP-based risk management program in place by November 2002. Generally, the effects of the legislation on HACCP not only help food chain stakeholders, but also individuals and customers, and all have responsibilities for the successful implementation of food safety programs in both developed and developing countries.

According to Cao et al., (2002), as HACCP is increasingly used as a food safety assurance program, concerns have been put forward about its effectiveness in enhancing food safety as well as on the impacts it may have on food markets, industry, and consumers. They also discuss issues associated with the adoption of HACCP and its impacts, which include: (1) HACCP as food safety regulation; (2) benefits and costs of HACCP; (3) impact on market structure and in the distribution of regulation costs; and (4) HACCP as an international trade standard (see Part C, Appendix 6 for details).

2.2.2 HACCP and other prerequisite programs

As mentioned in Section 1, HACCP is a necessary, but not a insufficient, condition for ensuring food supply chain safety. What that means is that HACCP cannot be effective when applied as an isolated system. It must be supported by prerequisite programs (Sperber, 2005). Therefore, each company is required to have its own HACCP plan tailored to its individual products and required prerequisite programs prior to the implementation of HACCP. Prerequisite programs, such as Good Manufacturing Practices (GMP) and Standard Sanitary Operation Procedures (SSOP) are an essential foundation for the success of an HACCP plan (NACMCF, 1997). GMP is standard guidelines set out by the FDA to ensure drug development is carried out in safe and quality processes, to avoid contamination and ensure repeatability. GMP to ensure that the products produced meets specific requirements for identity, strength, quality, and purity. SSOP is applied to all processing areas, equipment, utensils, storage and parameter areas that require wet or dry cleaning and sanitizing or verification as under HACCP on known schedules that are validated through inspections, monitoring and testing recordkeeping protocols. Besides, SQF (Safe Quality Food) and BRC (British Retail Consortium) standards have relation to HACCP and food safety. The SQF (Safe Quality Food) provides the food sector (primary producers, food manufacturers, retailers, agents and exporters) a food safety and quality management that is tailored to requirements of food safety and commercial quality criteria in a cost effective manner. BRC is used for all food stuff companies producing private brand products as well as for food industry organizations selling to Great Britain and being urged by British food chains to provide evidence of fulfilling their requirements regarding product safety, quality and legality.

Huss and Ryder (2003) indicate that it is important to point out that the prerequisite program certainly relates to safety and therefore is an essential part of a total quality control program. Thus part of a prerequisite program (e.g., sanitation controls) must lend itself to all aspects of a CCP, such as establishing critical limits, monitoring, corrective actions, record keeping, and verification procedures. Practical experience has shown that if the general issues related to the prerequisite program are dealt with first, the HACCP study will be much more straight forward and the resulting HACCP plan easier to manage. All

issues related to hygiene programs applied to all processing areas, equipment, utensils, storage, and parameter areas will be dealt with in the prerequisite program. It is noted that the prerequisite program is a good starting point for companies who have a long way to go towards implementing an HACCP system. In addition, food safety failures are both failures of HACCP implementation and of cleaning and sanitation practices or a lack of management awareness of and commitment to providing the necessary training and resources. That is why the HACCP cannot be effective when applied as an isolated system. It must be supported by prerequisite programs. It is suggested that appropriate prerequisite programs must be paid attention to and applied at each step in the whole chain. Similar attitudes were mentioned in the studies of Mortimore (2001); Panisello and Quantick (2001), and Motarjemi and Mortimore (2005). As far as the above reasons are concerned, Sperber (2005) indicates that it is better to focus on the application of effective food safety control measures because "Farm to Table Food Safety" (combination of HACCP and prerequisite programs) is better communication than "Farm to Table HACCP" (only HACCP applied).

In many countries, the implementation of prerequisite programs is a necessary condition in order to achieve an HACCP certificate. They refer to measures and requirements which any establishment should meet to produce safe food. In other words, HACCP ensures food safety through an approach that builds upon foundations provided by GMP/GHP. The combination of GMP, SSOP and HACCP is particularly beneficial in that the efficient application of GMP and SSOP allows HACCP to focus on the true critical determinants of safety. However, according to the regulations of each country GMP/GP (most developed countries) or both GMP and SSOP (developing countries like Vietnam, Thailand, Bangladesh) are used as the prerequisite programs.

In short, HACCP is a system, which ensures food safety through preventive measures. It is very effective in controlling identified hazards. Most importantly, it relies upon product design and process control not product testing to ensure food safety. Food safety is based upon the principles of preventing food safety problems (HACCP) and on prerequisite programs. To do this, it is necessary to ensure that both the food industry and government are carrying out appropriate roles and responsibilities as well as setting regulatory activities to control food safety risks. In other words, HACCP is a necessary, but insufficient, condition for assuring food safety. Food safety consists of an HACCP system and other prerequisite programs throughout the whole supply chain. Hathaway (1999) and Stewart et al. (2002) made similar definitions. An HACCP system can be effective only if it is based on GMP/GHP. Consequently, it is the responsibility of government agencies to ensure that these prerequisite programs are implemented before assessing HACCP implementation in the food companies

(Ababouch, 2000). Implementation of the HACCP program produces the following benefits:

- HACCP offers enhanced safety
- HACCP focuses on essential factors, allows for a better use of resources and is cost-effective
- HACCP, specific and flexible, provides a more timely response to safety problems
- HACCP is informative for those involved in its implementation
- HACCP provides an appropriate answer to product liability
- The principles of HACCP can also be applied to other quality attributes
- HACCP can aid control by regulatory authorities
- HACCP can promote international trade by increasing confidence in food safety

2.3 The role of government and industry in food safety assurance

Food safety experts from Asia (India, the Philippines, Thailand), Africa (Morocco, Burkina Faso, Ghana, Mauritania, Senegal), Latin America (Brazil, Costa Rica, Guatemala), and representatives of France, Germany, the United Kingdom, WB, FAO, WHO, and members of the European research community emphasize that food quality control cannot be applied successfully in each country without the support of government and industry (Hanak et al., 2002).

Kvenberg et al. (2000) discuss the role of the government and the industry in ensuring food safety. The government's responsibility is (i) to mandate the regulatory requirements for HACCP implementation; (ii) to establish mandated critical limits when necessary; (iii) to establish criteria, methods and sampling plans when necessary; and (iv) to verify that in individual facilities HACCP plans are adequate in order to assure food safety. Additional government activities should be to use epidemiological and scientific data to identify hazards and conduct risk evaluations. The evaluation results aim to provide information which can be used to improve HACCP plans; support research relating to CCPs, critical limits, and monitoring procedures; cooperate with interested groups in identifying new food safety hazards and identifying strategies for their control; encourage and participate in educational programs to promote the use of HACCP; cooperate with industry in the development of generic HACCP plans; and, finally, exercise whatever actions are deemed necessary to prevent unsafe food from reaching consumers. In terms of industry responsibilities, the industry must develop, implement, and maintain an effective HACCP system, with each facility forming an HACCP team that is responsible for the HACCP plan.

As an example of the implementation of a governmental role, Hanak et al. (2002) mention that the government in the UK appears to play a crucial role in developing policy, promoting legislation, and implementing EU legislation. The role lies mainly in the Ministry of Agriculture, Fisheries and Food (MAFF) and the Department of Health (DoH), along with the Scottish, Welsh and Northern Ireland Offices. Specifically, MAFF has an important role to play in promoting the economic interests of the agriculture, fishing and food industries and this is particularly valuable in the international arena. In Canada, an important feature of the food safety system is the respective roles of the Federal and ten Provincial governments. If meat, poultry or seafood is to be moved inter-provincially or exported, Federal government regulations apply. The annual report of the Auditor General of Canada released in Nov. 1999 was sharply critical of the lack of coordination between Provincial governments and other relevant institutions in responding to a nationwide salmonella outbreak in 1998. Under the Australian constitution, State governments are responsible for the enforcement of food law, with that responsibility extending back to the farm, development of national food standards for further processing, distribution and retail (Jill et al., 1999).

Some aspects that the government, according to Hanak et al. (2002) and Jill et al. (1999), can support are: quality control programs, training, research, role of consultant, as well as logistical supports. Billy (2002) also adds that industry and government have a very important role to play in the implementation of FS by setting standards for food safety and other consumer protection concerns.

According to Billy (2002) and Suwanrangsi (2000), although many food companies have excellent HACCP programs, they need to improve their performance in conducting hazard analyses, reassessing their plans, and validating the measures they adopt in addressing those hazards because there are many gaps and deficiencies in HACCP implementation. Therefore, discovering areas where improvements are needed, such as in risk management, infrastructure and resources, communication, training and education and workplace environment, are all crucial. As noted by Ababouch (2000), the HACCP principles play a pivotal role in preventive approaches. Their application is the responsibility of the food industry, whereas the government control agencies are responsible for monitoring and assessing their proper implementation. The responsibility of the government inspectors is to ensure that the HACCP program used by the food processor is properly designed and properly implemented. In this respect, assessment of the HACCP program can be done in two steps. First, an assessment of the HACCP manual which is basically a document review. Second, an on-site verification to establish whether the approved HACCP manual is properly being implemented.

Regarding the industry role, several countries are exploiting the possibility of privatization of elements of hygiene inspection (especially in the meat, poultry and seafood sectors) and this requires different legislation and infrastructure as

compared with traditional programs. Traditionally, the industry has had the primary responsibility for GMP-based process control, and now it has the primary responsibility for HACCP-based process control (Lee & Hathaway 1999). Moreover, to Motarjemi and Mortimore (2005), there are many measures that the food industry can use to manage food safety in a more efficient manner and reassure public confidence in the food supply. Such measures include regulations and policies, guidance on hazards, risk communication and education, incidents and crisis management. Industry needs to revisit its approach to training, to recognize that we have different levels of maturity, to make improvements at the primary production levels. Primary production is at the start of the food chain and perhaps too little attention has been focused in this area. Although much has been done in the last few years, much remains to be done. Although we are not operating to common standards worldwide, agricultural practices in the industrialized countries may be used to help developing countries.

Governments in the developing world face multiple demands and have a limited capacity to respond. In light of governments' own resource constraints, donor agencies play a key role in improving developing country food safety management (Hanak et al., 2002). Regarding fish exports, there are two impacts from developing countries. Positive impacts are anticipated to be a strengthening of ties between government and industry regarding fish quality, a stronger commitment to improve fish quality, adoption of safety and quality improvement programs such as HACCP, and more training and education in quality and fish inspection processes. Negative aspects are lack of trained personnel, lack of financial resources, lack of communication between inspection authorities and lack of clear instructions from the importing country on conditions that must be met (Santos et al., 1993).

Some problems have been identified in some countries as reported by Marthi (1999), who finds that the Indian FS challenge is a mirror of the situation in most of the developing nations. Food industry professionals and government regulators must take due cognizance of this fact. Government, Industry, Academia and the community will meet to work closely, together with international agencies, in order to develop the most effective food safety regulations. In fact, there was a lack of adequate infrastructure for handling large scale food processing. A key issue is development of effective cold chains, given the high ambient temperatures and significant variability in power availability. Bangladesh also reported managerial problems that have caused micro-bio contamination, such as salmonella in frozen shrimp and prawns. To overcome these problems, both industry and government made major investments in more modern companies, laboratories and personnel trained in HACCP procedures (Unnevehr, 2000).

Even though the HACCP concept is one of the most effective and efficient ways of enhancing food safety, food industries in developing countries should be aware that it will not give complete protection even under the best conditions. This is another constraint: processors must be ever vigilant and prepared to act if any breakdown in standards is detected (Jirathana, 1998). To comply with the requirements of export markets, developing countries' national governments have developed quality control systems to sustain their exports. In many developing countries, where food firms' quality control systems are not well developed or implemented, both practice and attitude is that inspection and quality certification for export are the responsibility of the government (Zaibet, 2000).

As a conclusion of this section, for Fearne (1999) the food industry has a vested interest in supplying better information along the length of the supply chain. Governments have both a duty and a vested interest in facilitating the process. Besides support from the government, the food supply chain itself, which consists of production, from processing to marketing, should be supported by the food industry, support organizations, local departments and other chain stakeholders in order to achieve product quality control objectives. Furthermore, Suwanrangsi (2002) notes that the interaction between provincial government agencies and the fisheries industry is vital for promoting the sector's development through the introduction of new technologies, extension, research, training, regulation and inspection. Finally, McDonough (2002) also concludes that the HACCP experience shows that government has a role to play in its successful introduction, and that this can be a challenging undertaking for all parties concerned.

2.4 Current situation of HACCP implementation in the world

2.4.1 HACCP and international trade

Changing consumption patterns for food, as well as changing global trade practices, can make huge impacts on food safety and risk assessment. Several countries have either mandated or are considering mandating HACCP requirements into their national legislation and they are specific in their HACCP requirements for particular sectors of their domestic food industries. The expectation is that exporting countries will meet the same requirements for internationally traded foods (Hathaway, 1999). In particular, the introduction of HACCP-based regulations for fish and fish products, particularly in the EU and the US, has triggered the need for production under the HACCP system in most fish exporting countries. It is reported that approximately 60% of the international fish markets require that fish and fish products are processed under HACCP systems, of which the EU and the US account for 50%, while Japan at 34% has not yet required HACCP compliance (Lupin, 1999).

Van Veen (2005) also argues that participation in global trade means that countries have to live by international rules and to consider major investments in food safety promotion and monitoring. Especially, chain partners of producers need to have a common standard/policy to ensure the quality and safety of products and to guarantee social acceptance.

By 1990, HACCP had become the primary approach for ensuring the safety of the food supply (Buchanan, 1990). Since then, there has been considerable effort to harmonize the use of HACCP by national and international institutions and to manage food safety hazards in the food industry worldwide (Panisello & Quantick, 2001). Besides, HACCP is intended to address hazards which are of such a nature that their elimination or reduction to acceptable levels is essential for the production of safe foods (Orriss & Whitehead, 2000). Furthermore, for Gillespie et al. (2001) the effectiveness of the HACCP system is evidenced by a better microbiological quality of food originating from small establishments with HACCP in place than from those without. Therefore, many governments have taken a risk assessment approach to ensuring the safety of the food supply and have mandated the use of an HACCP system in food industries (Unnevehr & Jensen, 1999; Ropkins & Beck, 2000).

Lee and Hathaway (1999) mention that "food exporting countries are now inextricably bound to comprehensive HACCP-based food control systems if they are to effectively assure the safety of food in international trade, and meet the market access requirements of an increasing number of importing countries. It remains the primary responsibility of industry to develop, implement and maintain HACCP systems. The supporting role of the regulator should be to enact supporting legislation, facilitate scientific design, ensure consistent applications, and verify the integrity of HACCP systems on a national basis. Further, continuous government effort is needed to improve the knowledge base relating to emerging hazards such as E.coli O157:H7 and thereby improve the ability of HACCP plans to meet specific public health goals. As new scientific approaches to HACCP evolve and risk assessment improves, bilateral and multilateral recognition of the legitimacy of different approaches to the design of HACCP plans in different countries is becoming a critical issue for food in international trade".

Therefore, there is a need to close the wide gap between developing and developed markets in terms of knowledge and quality of institutions. Above all, to profit from the emerging opportunities, chain partners in developing countries and emerging economies must shift from an internal product orientation to an external market orientation. For instance, adapting HACCP systems and audits to suit local conditions in developing countries and also help in formulating HACCP for niche products exported from developing countries. Moreover, avoiding any confusion through the introduction of obligatory competing or overlapping multiple requirements, such as a mix of HACCP, BRC or SQF

(Safe Quality Food), may make sense in well-organized western markets, while the costs of such a mix may be prohibitive for small countries and small traders. A perception of excessive documentation has previously been reported (Orris & Whitehead, 2000; Hathaway, 1999). Furthermore, regarding the role of international organizations in food safety, a constructive collaboration of consumer organizations with other stakeholders in the food chain, as well as through a concerted and coordinated approach for communication with the public, is a key to regaining the trust of consumers in the food supply chain (Motarjemi & Mortimore, 2005).

It is noted that in response to increasing consumer concerns about food safety, regulators in the EU, the US and Japan have been raising the bar that food suppliers need to meet in order to be able to sell on their markets. This includes stricter norms on pesticides and veterinary drug residues and mycotoxins – some of which are powerful carcinogens – as well as on microbial contaminants. In addition, Hanak et al. (2002) emphasize that quality needs to be managed not only in the processing company but also along the whole supply chain, from the initial stages of raw material production to the final stages of food preparation for consumption.

In short, while the improved level of food safety associated with the implementation of HACCP and the leading role taken by the food industry are recognized, the application of HACCP as a public policy requires a definition of the role of government in the HACCP process. Recent moves by some importing countries to require application of HACCP principles by exporting countries to food produced for export may result in significant trade barriers for countries unable to meet these requirements. The mandatory requirement for HACCP use and any subsequent barriers or other constraints to trade for developing countries need to be considered and identified.

2.4.2 The implementation of HACCP in the world

One can generalize that the HACCP system in FS for prevention of hazards is now mandated for some or all of the food sectors in the EU, the US, Canada, New Zealand, and Australia (Unnevehr, 2002). In fact, the food safety concept may be differently interpreted in different nations as food preparation and food consumption habits differ. Therefore, the introduction of food safety management in general and HACCP in particular needs to be built on local skills and concepts. At the very least it should be built on mutual understanding of each partner's perception, and participatory approaches. Mutual understanding, however, assumes certain minimal skills (farmers, inspectors, veterinary staff, etc.) and an understanding of the concepts of standards and risk assessment (Van Veen, 2005).

Focusing on seafood quality and safety, Cato (2000) reports that HACCP was recommended as the most effective way to monitor the safety of fish before

1985. The use of HACCP in the seafood industry has taken on a global perspective in the production of fish and fisheries products (Santos et al., 1998). They report the results of an FAO survey that categorized the status of countries and the seafood industries in those countries in terms of their adopting HACCP seafood procedures. Countries whose governments and seafood industries have adopted or decided to introduce seafood HACCP include Canada, Uruguay, Brazil, Chile, Ecuador, Australia, New Zealand, Thailand, Iceland, the US and, more recently, Argentina, Peru, Ireland, Cuba, Morocco, Norway, Sri Lanka, Vietnam and Bangladesh. A second group consists of countries whose governments have taken unilateral initiatives to introduce HACCP via regulations with limited success and through cooperation between the regulatory authorities and the seafood industry. These countries include Mexico, Venezuela, and many countries of the EU, for example Italy, Germany and France. In a third group of countries, the private sector is taking the lead in voluntarily trying to introduce HACCP based programs regarding seafood export production. These include Madagascar, Venezuela, Honduras, Tunisia, Myanmar, and Portugal. A final group consists of countries where governments have decided to apply HACCP but have not yet defined the process, including Japan, Russia and China. The remaining countries where the status of seafood HACCP is unclear include Pakistan, South Korea, Iran, Colombia, Panama, some East and Central European countries, and most African States.

Billy (2002) reveals that FS in the US is based on HACCP and SSOP. HACCP is the industry's tool for meeting the relevant performance standards. Both FS objectives and corresponding performance standards are best accomplished through HACCP. FS in Malaysia combines the implementation of the HACCP along with GMP, hygiene and sanitation, and environment control (Merican, 2000). In Australia the food safety program is based mainly on HACCP principles. However, it was ultimately agreed that those food safety standards would not be applied to the entire food production chain as the primary food industry sector is specifically excluded. It was, however, recognized that the food safety standards could be applied to a primary food production activity if significant and unmanaged food safety hazards were identified in this sector (Martin et al., 2003).

In Canada, two food inspection programs have been developed to embody these internationally recognized principles of safe food processing – The Quality management Program (QMP) and the Food Safety Enhancement Program (FSEP). Under both QMP and FSEP initiatives, food manufacturers are responsible for the development, implementation and maintenance of HACCP food safety management systems to ensure compliance with health and safety regulations and trade agreements. These food safety management systems must include a hazard analysis, written procedures for control of hazards and written procedures for verifications of the system's effectiveness (Gagnon et al., 2000).

Kvenberg et al. (2000) report the US experiences in dealing with HACCP for seafood plants from a regulatory perspective. They are (1) GMP, SSOP considerations as a prerequisite to HACCP implementation; (2) General HACCP principles; (3) verification methods of industry development, implementation, and maintenance of effective HACCP systems; (4) performance standards; (5) engagement in internal and outreach programs of education and training; and (6) sponsorship of research to improve HACCP systems functionally. Besides, measuring the effectiveness of a new food safety program such as HACCP is an important consideration if regulatory agencies are to develop information on the advantage of conducting an HACCP-based audit over conducting a sanitation based inspection. Both the food industry and the regulatory agency share the same goal of ensuring a safe food supply. However, there are HACCP implementation difficulties in some industry segments because the general principles of the HACCP are not fully understood. Despite these difficulties, however, numerous HACCP program successes have occurred. These include successful implementation of SSOP in 6000 meat and poultry plants and a significant reduction in the prevalence of salmonella in poultry plants where HACCP has been implemented.

According to Lee and Hathaway (1999), New Zealand and other countries (Canada, Uruguay, Brazil, Chile, Ecuador, Australia, Thailand, and Iceland) consider the implementation of HACCP systems to be an important component of safety for food in international trade. Given that the global experience regarding HACCP across all food sectors, especially in primary production, is relatively new, both importing and exporting countries have much to learn in assuring that the safety of food in international trade is underpinned by HACCP systems that are scientifically derived, risk-based and equitable.

However, Eves and Dervisi (2005) note that there is little doubt that HACCP is becoming more widely accepted throughout the UK food industry. Its successful implementation, however, requires an understanding of its principles and a commitment thereto by all levels of the workforce. HACCP per se does not make food safe; it is its correct application that can make a difference. In order for this to be achieved, the barriers to HACCP should be assessed and their impact evaluated. Until these barriers have been resolved, HACCP systems will not be able to reach their full potential. Barnes and Mitchell (2000) made similar observations.

Although there are many papers presented and discussed about experiences of HACCP implementation as above mentioned, successful experiences of Thai fisheries in the application of HACCP presented by Suwanrangsi (2002) are good references for Vietnam's fisheries industry in general and for SFCs in particular due to the same conditions of HACCP implementation.

2.5 Food safety constraints and problems in developing countries

The international workshop on food safety management in developing countries, as reported by Orris, and Whitehead (2000), Hanak et al. (2002) and Van Veen (2005) emphasizes that prominent food scares and change in the international trading environment have brought food safety to the forefront of international agri-food policy concerns. Recent trends include an increased emphasis on food safety regulations in international trade, a tightening of standards, a reorientation of private sector quality control techniques toward preventive management, and a corresponding shift by regulatory agencies toward process-based standards including mandatory HACCP in the food supply chain. In fact, in order to meet FS requirements in international trade, the application and development of HACCP in developing countries still encounter constraints in terms of deficiencies in basic hygiene measures such as environmental controls, management of employee hygiene, investment in technology, equipment design, and management of cross contamination. These constraints are managerial as well as technological.

2.5.1 Technological constraints in HACCP implementation

Oriss (1999) and the discussion of world experts on food safety (2002) indicate that many developing countries have difficulty overcoming the technical deficiencies and providing new technological investment. They frequently require technical assistance in order to fully understand and implement the sanitary measures. Besides, there are differences among food companies in terms of the level of technical expertise, along with the pressures and incentives for management to adopt the HACCP concept. The introduction of HACCP systems in developing countries has depended very much upon the level of technology. The larger companies usually have modern equipment and excellent technical support, but the smaller operations may have no technically trained staff and they may be using traditional equipment and methods to produce a large range of products (Jirathana, 1998). Besides this, Panisello et al. (2000) discuss that improving the microbiological quality of foods alone is insufficient, since food processing technologies cannot always guarantee the absence of pathogens. Foods can also easily become recontamination. Therefore, efforts must be made to adhere strictly to hygiene measures by following GHP, GMP and by stringently implementing HACCP along the whole food chain. Similar attitudes have been observed in the study of Legnani, et al. (2004).

These issues aside, food processing technologies are also applied to increase digestibility, enhance the edibility of food, intensify sensory quality, increase shelf life, improve nutritional quality, and/or render food safe. Food processing technologies implemented at either the household level (e.g., farms, collectors and wholesale buyers), or at the industrial level are designed to optimize all of these properties in the final product. All of the above objectives can rarely be

achieved using a single operation (Motarjemi, 2002). For instance, the application of the basic rules of food hygiene will help prevent contamination, growth and survival of pathogens in foods and will reduce the incidence of diarrhoea diseases.

2.5.2 Managerial problems of HACCP implementation

Managerial problems in developing countries in HACCP implementation also encompass the internal and external ones of food companies. A key point of external managerial problems is issues of HACCP inspection and audit. In contrast, activities regarding employee hygiene and training are main internal management problems. Eves and Dervisi (2005) mention the role of management in implementing and maintaining HACCP. In almost every food company, HACCP management has been implemented. Managers and most of the head chefs have been trained specially in HACCP because of a perception that HACCP would be too complicated for their employees. Thus, a major part of the monitoring has been performed by those who are qualified or trained (quality control staffs, managers) and the less hazardous jobs are performed by other employees. Managers at all levels have understood their role to be an important one because they recognized on the one hand that their attitudes towards the system affected the way their employees behaved. Which employees are trained and at which level and how their roles for FS are managed are, on the other hand, managerial problems. The more interest and excitement they show in their job and the more committed the managers are, the better the result obtained. A number of other authors (Panisello & Quantick, 2001; Mortlock et al., 1999; Easter et al., 1994) have also identified the same managerial problems in HACCP implementation and maintenance regarding management attitudes and commitment to employees.

In addition, a variety of problems in the application of HACCP have been reported by Panisello and Quantick (2001), Mortlock et al. (1999), Panisello et al. (1999), and Ward (2001). The most important problems reported were the level of knowledge shared by employees, various time constraints and additional documentation. Managers seemed to find it difficult to make their employees understand the importance of hazard analysis and why particular operations had to be monitored and controlled. To overcome this they ensured that adequate supervision was in place and that people who had problems with the system were identified and retrained. Time-related issues in correctly applying all monitoring procedures and controls were noticed, especially during busy times. Panisello and Quantick (2001) report similar issues. During busy times there was a tendency to forget personal hygiene and the completion of required documentation. An insufficient identification of hazards was also reported by management as a problem when the HACCP system was beginning to be introduced in food companies. Panisello et al. (1999) previously reports that inadequate hazard identification is a major drawback to the effective

implementation of HACCP. The problem seems to have arisen because of the lack of understanding of what hazards are and how they should be identified and incorporated into the system. This indicates the sort of background that a manager should have when implementing an HACCP system.

Moreover, the uncertain authority of employees who are responsible for taking corrective action is one of the problems that should be considered in developing countries. In principle, the top management must themselves commit to fully supporting the authority of those to whom they give responsibility for corrective action. However, sometimes top management can be governed more by economic factors than by the safety aspects of the company's products. It is difficult to convince top management to fully accept the HACCP principles throughout the whole chain. In addition, there is a shortage of effective and experienced auditors. Auditing involves more than access to records of CCPs, assessment of HACCP manuals, sampling at CCPs and verification of records (Dillon & Griffith, 1996). Auditors should also inspect production lines and other facilities to ensure that any new hazard has been identified and taken into account; also their focus should be extended to food safety auditing (Peters, 1999; Taverniers et al., 2004; Leaper and Richardson 1999; and Orris, 1999).

2.5.3 Techno-managerial constraints of HACCP implementation in Vietnam

Like some developing countries, the HACCP implementation of Vietnam's SFCs in general and in the MD in particular is facing constraints in terms of management and technological investment. There is a lack of strict quality management by the government, industry, support organizations, SFCs, and chain stakeholders from "water to table." In addition, restrictions on quality knowledge, techniques, infrastructure, and technological and equipment investment throughout the chain are a big challenge for seafood quality and safety. Moreover, because the HACCP has not yet been introduced at the primary production level, the roles of the government (the Ministry of Fisheries, local government departments), SFCs and support organizations (VASEP and NAFIQAVED) throughout the chain are vital. Those are the reasons why food safety and quality by means of the techno-managerial approach, the combination of supply chain management and quality management, the role of the government, SFCs and other relevant organizations are crucial in order to provide a detailed understanding of their roles in solving research problems.

2.6 Techno-managerial approach for food safety and quality management

There are many approaches for implementing chain food safety quality control. One, for instance, is an integrated and science-based approach as presented by Sheridan et al. (1996). This approach is based on shared responsibility, the use of HACCP principles/practices and the introduction of leading technologies and detection methods within government and across the food industry. The process involves defining accountabilities more clearly across the entire food continuum and working with partners and stakeholders more closely. Other approaches, such as the FAO approach, as well as the integrated approach of Kailis et al. (2000), focus mainly on elements of general design and operation of hygienic premises, and equipment and training of personnel. However, the techno-managerial approach indicated by Luning, et al., (2002) and Poon & Lijanage (2003) ranks highly in solving research problems because there is an integration of managerial and technological sciences.

2.6.1 Techno-managerial approach

Luning, et al. (2002) and Poon & Lijanage (2003) mention that food quality management embraces the integrated use of technological disciplines as well as the integrated use of managerial sciences. The following figure describes three different approaches – the managerial, the technological and techno-managerial approach. They differ in their extent of integration of managerial and technological sciences.

- The managerial approach means that technological aspects are contemplated as facts: we can make everything we want to make. In fact, there are no technological restrictions.
- The technological approach means that management aspects are considered as boundary restrictions: we cannot make everything we want due to technological restrictions.
- The techno-managerial approach encompasses integration of both technological and managerial aspects. Quality problems are considered interactively from both a technological and managerial viewpoint. This approach is suitable for solving seafood quality problems in the MD because seafood supply chain problems in general are now faced with technological and managerial restrictions as well as technical and local infrastructure problems. Moreover, a good example of techno-managerial thinking is the HACCP system, wherein critical hazards are controlled by human control and monitoring systems, and consumers' wishes are translated into technological requirements through an intensive and organized collaboration of different departments in the company.

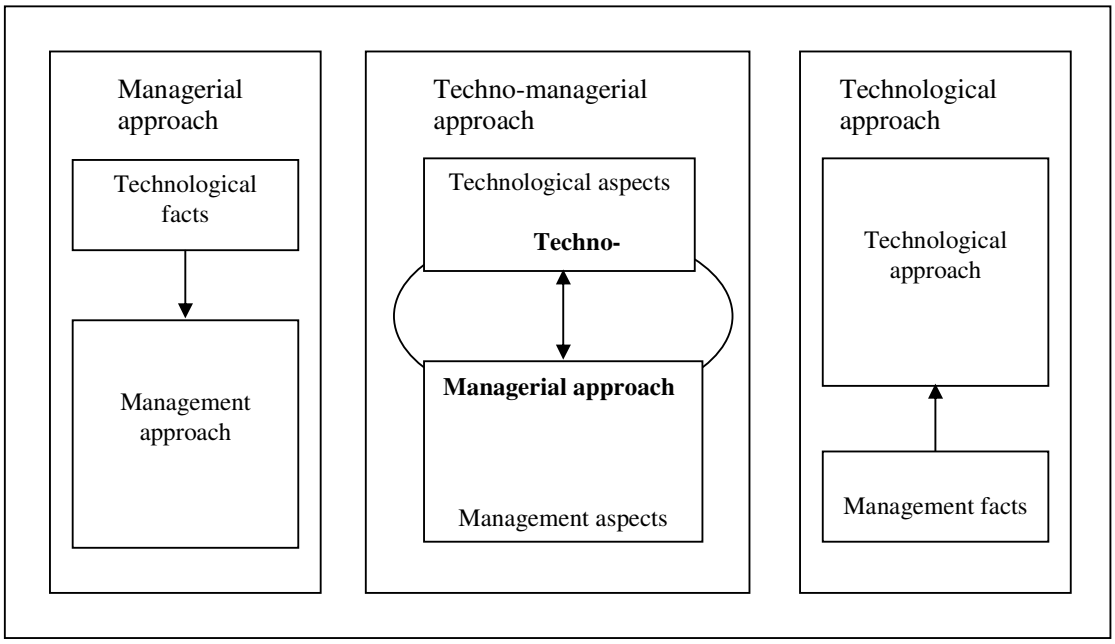


Figure 2.1 Different approaches to food quality management

In addition, Banati et al. (2002) emphasize in Food Safety and Quality that the ability to integrate technological and managerial knowledge is very important for food safety and quality design, control, improvement, and assurance. With a particular focus on food safety and quality the quality management skills needed are:

- ability to apply the techno-managerial approach in food production processes
- ability to develop and use models for (statistical) quality control
- ability to solve problems
- communication skills, with a focus on stakeholders
- ability to work in multidisciplinary teams

2.6.2 The food quality management model by means of a techno-managerial approach

Figure 2.2 shows how the techno-managerial approach resulted in the food quality management model (Luning et al., 2002).

The model includes:

- the organization in its environment, wherein
- management and technology interact, striving for
- product quality that meets or exceeds customer expectations

- wherein technology is perceived as a technological system, with complex interactions fulfilling different functions in order to meet product quality requirements, and
- wherein management is perceived as a management system with complex interactions fulfilling different functions in order to activate the technological system and give it the right direction, while ensuring that it meets customer expectations.

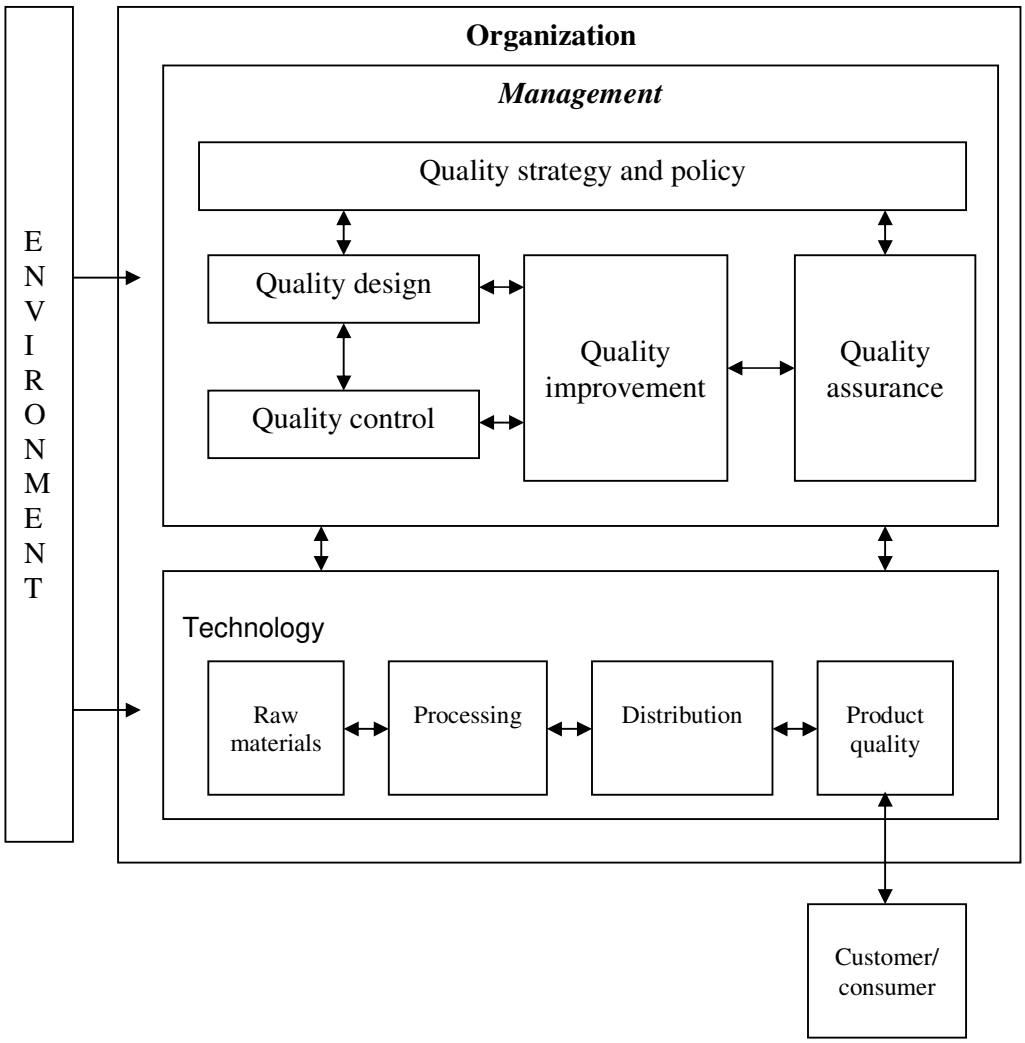


Figure 2.2 Food quality management model (Luning, et al., 2002)

Furthermore, the objective of quality control is to guarantee that quality requirements, such as product safety, reliability, service, etc., are realized by the quality system. On the other hand, quality control should provide confidence to customers and consumers that quality requirements are being met (ISO, 1998). A quality system is defined as the organizational structure, responsibilities,

processes, procedures and resources that facilitate the achievement of quality management (NNI, 1999). In the food industry several quality control systems (QAS) and norms have been developed but they differ in their quality focus (e.g., food safety, supply guarantee, total quality) and their approach (Hoogland et al., 1998; Waszink et al., 1995). With respect to approach, GMP and HACCP mainly focus on assurance by technological requirements, whereas ISO is more focused on management. Figure 2.3 illustrates how the common QAS are mapped by means of their technology and management focus.

Because GMP/GHP involves guidelines that are aimed at assuring minimum acceptable standards and conditions for processing and storage of products (buildings, processing technology, equipment, and utilities), it has a technological focus and is a basic condition for other systems like HACCP. An ISO-based quality system, on the other hand, consists of all activities and handling being established in a procedural way, which must be followed by ensuring clear assignment of responsibilities and authority. In actual practice, procedures on all relevant topics had to be established, then carried out, and controlled. This brings a management focus into the forefront. The role of HACCP is a necessary step in transforming a technological focus into a management focus and is also a basic condition for ISO/TQM application and success.

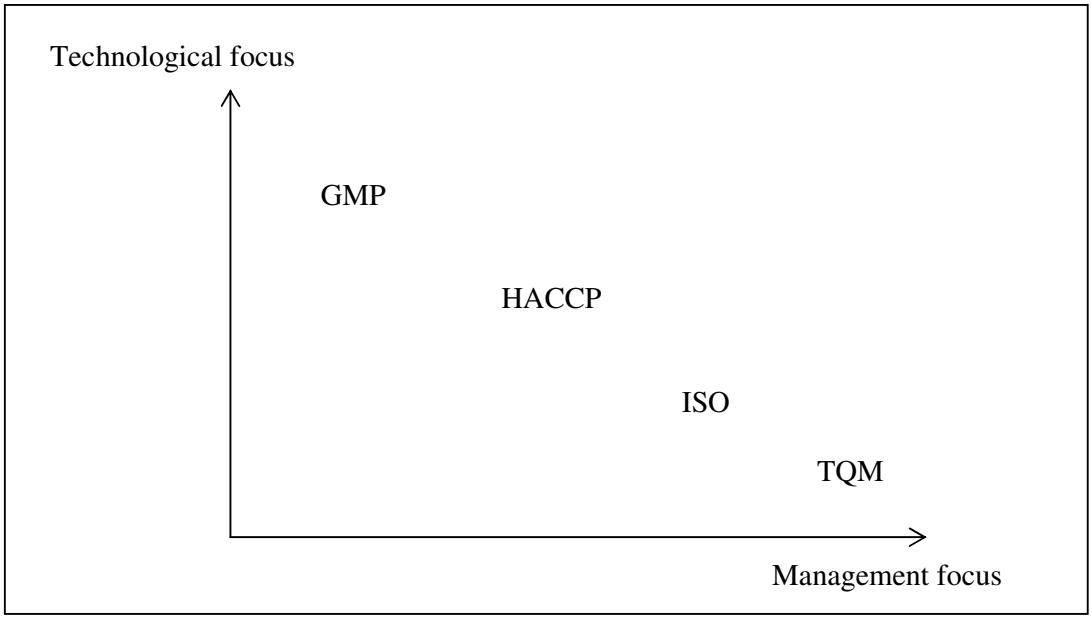


Figure 2.3 Common QAS schematically mapped according to their technological and management focus

This point of view towards quality control systems is also discussed by Nicolaides (2002), where linkages are established between what are typically viewed as successive stages of the preventive approach to quality control (GMP, HACCP and TQM) in individual supply chains. Similarly, Jouve (1998), Huss and Ryder (2003) emphasized that GMP and SSOP are generic requirements. The HACCP is a specific requirement for food safety management, while ISO includes all quality elements that need to be assured and managed and TQM is a long-term managerial strategy. Lackova (2001) also mentions that the HACCP system is a more narrowly applied system for ensuring the quality of products and one which is compatible with other systems such as quality systems following ISO 9000 and TQM.

Furthermore, food companies aiming to achieve a certificate for their system of quality according to ISO 9000 are bound to work out an HACCP system for respective products, processes and phases of production, which simultaneously observes a certain progression of steps determining decisive points in this system. Therefore, food companies have to start work on building up a quality system through implementing just such an HACCP system for use as a specialized instrument and as a specialized part of the quality system. On the other hand, construction of an HACCP system does not yet mean the fulfilment of all requirements of ISO 9000. The common points of both systems lie in following the elementary points of ISO 9001: a quality control system, requirements for purchased products, identified ability and the ability to follow the product, operational management, manipulation, storage, packaging, protection and supply, internal audits, operational management of quality recording, training and preparation of workers, statistical methods, etc.

The application of ISO 9000 international norms and the HACCP system are individual steps toward achieving minimum European quality standards and thus the ability to compete on the food product market (Lackova, 2001). Although ISO 9000 and HACCP both focus on preventing not detecting or correcting problems, an important difference is that HACCP focuses on the product and ISO 9000 on the system. The development of the HACCP plan identifies critical control points and procedures or activities identified in order to adequately control them so as to ensure safe production of a food product. The ISO 9000 quality management system provides the structure and foundation for the maintenance of the quality system, while, as such, certification for conformity to an ISO 9000 standard will not actually certify the product. What it does certify is that the approved company has a quality system that meets the scope of the stated standard (Newslow, 2003).

Cato (2000) emphasizes that HACCP programs in both developed and developing countries often include quality standards as well as safety standards in their program design. However, in European countries HACCP is more broadly defined as part of an overall ISO 9000 system because of the better

conditions of management, capital, quality knowledge and technological investment. Therefore, seafood companies can be certified to meet various ISO 9000 standards. SFCs in Vietnam follow the EU approach. It means that they have applied HACCP as part of an overall ISO system and as a prerequisite condition to achieve ISO certification.

2.6.3 Food supply chain management

Food supply chain management covers the management of the food supply system from the farm, to food manufacturing, to retail and wholesale markets, and to consumer issues (Bourlakis & Weightman, 2004; Eastham, et al. 2001). Relevant issues to the management of food chain include (1) The food supply chain management environment, (2) The food consumer, (3) Public conceptions of risk and product safety in the food supply chain, (4) Procurement and supply chain management, (5) Food Manufacturing, (6) Food retail and wholesale, (7) Food strategic alliances and networks, (8) The impact of information, (9) Technology and electronic commerce in the food supply chain management, and (10) The future of food supply chain management (Bourlakis & Weightman, 2004). Regarding food chain safety and quality, Luning et al., (2002) also mention that food quality management must attain quality and safety standards stemming from customers' requirements and expectations. These requirements and expectations are transformed into the company's performance quality objectives. To implement these objectives, partnership relationships between food companies and their chain actors, and even with loyal customers are crucial. So far, SFCs in the MD do not satisfy the managerial and technological conditions and lack the financial possibilities to implement the ten topics of food chain management. For instance, internal competition among SFCs still exists, chain actors' quality knowledge is low, chain information is insufficient and, especially, relationships between SFCs and between SFCs and their chain stakeholders are still weak.

2.7 Summary

The literature reviewed has provided grounds for diagnosing a supply chain quality management framework and a quality improvement process. The theories and concepts with reference to the HACCP role in the food supply chain safety and food quality management by means of a techno-managerial approach are described. More especially, HACCP implementation and the experiences of HACCP application in the world's food chains are mentioned in detail. This Chapter has also shown the important role of government, industry and other relevant organizations in the food chain safety as support organizations for successful implementation of an HACCP program.

Chapter 3

Seafood Supply Chain Quality Issues And Discussion In The Mekong Delta, Vietnam

As mentioned in the chapter devoted to a review of the literature, nowadays throughout the food chain, food safety in general and HACCP implementation in particular are main concerns in the international food trade, as well as for food companies around the world. In addition, constraints on management and technology, which ensure food safety in the supply chain, are big challenges in developing countries. The role of the government and industry is also still important in managing and ensuring supply chain food safety. The situation in the shrimp supply chain in the MD has been made of the results of a chain survey. The survey relevant issues will be explained in more detail bellow.

3.1 Data collection by questionnaire

3.1.1 Questionnaire design

The questionnaire is designed as an important tool in establishing the research activities that are shown as series of steps in Figure 3.1.

- Step 1: Listing the information needed regarding seafood quality and the contents of quality standards applied at the SFCs in the MD.
- Step 2: Using both direct and indirect methods of interviews for collecting data and information.
- Step 3: Formulating 38 questions that set by 306 variables.
- Step 4: Using both unstructured and structured questions to ask.
- Step 5: Translating English questions into Vietnamese questions for collecting data.
- Step 6: Making sure the questions arranged from easy to difficult and from general to more specific.

- Step 7: Structuring four parts in the questionnaire – (1) general information of the interviewee and company business, (2) Company's shrimp quality through the chain, (3) the current situation of the company's quality management, (4) The HACCP and other quality standards.
- Step 8: Reproducing the questionnaire in a professional way.
- Step 9: Improving the questionnaire by a pilot survey conducted at the university and at the SFCs.

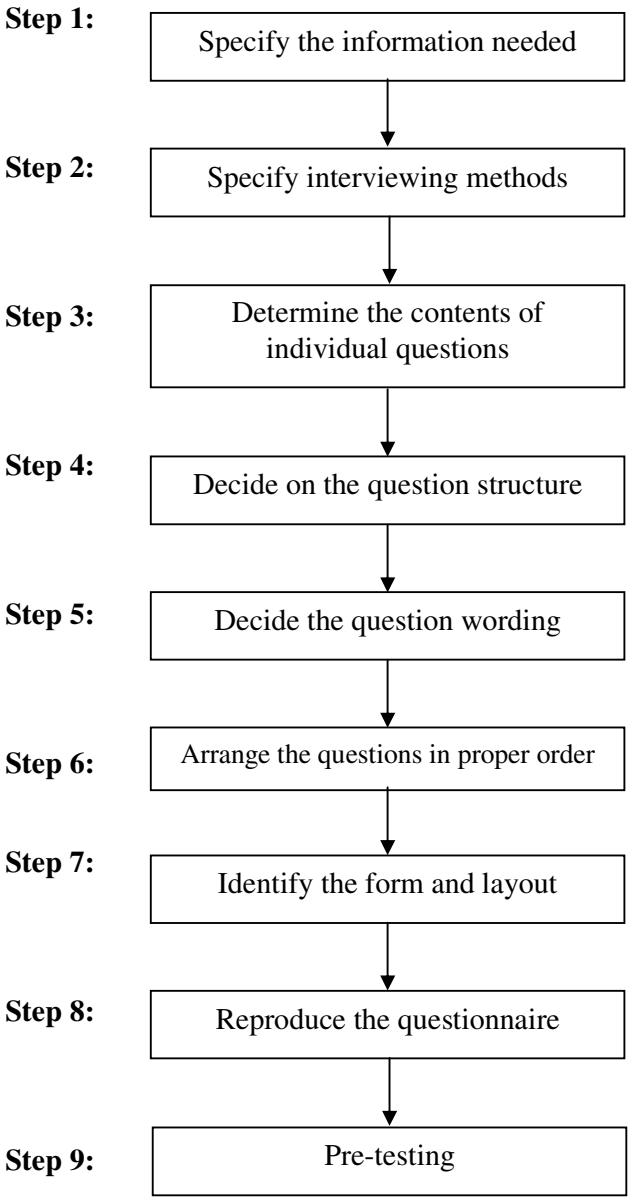


Figure 3.1 Questionnaire design process

Once the questionnaire has been developed, it is sent to some people in the survey population as a pilot survey (10 pilot questionnaires). Respondents to the pilot survey are quality controllers, deputy of the SFC's leaders and some teachers of Cantho University who are involved in fisheries quality subjects. The purpose of the pilot survey is to make sure that the questions are clear and easy to answer, and that they add more alternative questions/answers or cancel some unnecessary questions/alternatives in the questionnaire. Then, the questionnaire is adjusted, reproduced and used for the official survey. Primary data and information are collected through direct interviews with the SFCs' leaders and indirect interviews by sending questionnaires to 32 seafood companies. Primary data and information are also collected from local departments and other institutions/organisations in the twelve provinces of the MD.

3.1.2 Questionnaire contents

Data and information in the study come from interviews with SFCs and their chain stakeholders. The interviews were implemented directly with the SFC leaders and indirectly through a questionnaire for the people who are responsible for the company's quality control and who are involved in the chain.

The bases for establishing the questionnaire were the research objective, the interview results from ten SFC exploratory interviews in the MD and the research results from 94 SFCs in Ho Chi Minh City, research information requirements (seafood supply chain), literature reviews, and procedures of HACCP and other relevant quality standards. Then the questionnaire was modified for some pilot surveys in order to ensure that every question and its response alternatives were clear to the responder. People interviewed for the pilot survey included teachers who major in quality management and fisheries, leaders and quality controllers in each company. Finally, the research questionnaire was edited and used as the official survey for 32 SFCs in the region.

The research questionnaire contains four parts (see Appendix 1 for details). The first part consists of general information on the interviewee and the company. The information related to the interviewee concerns name, age, sex, function/duty, and level of education. These indicators describe the role, experience and position of the interviewees in the company. Moreover, the questions regarding general information about the SFCs also aim to provide a basic picture of the managerial activities and business operations of the company. This information not only reflects the company itself but also compares the company with other SFCs in the MD. All questions in this section were answered by representatives of the company's leaders. The second part of the questionnaire was answered by staff members of the company's quality control department. It focuses on issues related to quality in the shrimp supply chain of the SFCs in the MD. It includes the supplier's shrimp quality, shrimp

quality in processing and in the distribution process. The third part includes questions describing the current situation of the company's quality control management. It comprises questions concerning leadership, supplier quality management, processing control and improvement, quality system improvement, employee participation, education and training, and consumer focus. The topics in part three are discussed in terms of scale questions – using a 5-point scale *(gradual level of agreement: 1. Strongly disagree...and 5. Strongly agree).* In addition, at the end of each topic question the respondents are asked to give their reasons for choosing that number. The fourth part focuses on food quality standards such as GMP, SSOP, ISO, TQM, SQF, BRC, and particularly on the HACCP procedures and principles that have been implemented by the company. These are (1) assembling an HACCP team; (2) description of the product and its distribution; (3) identification of intended use and consumers; (4) development of process flow diagrams; (5) inspection of the process and verification of the flow diagram; (6) assessing the hazards (Principle 1); (7) determination of Critical Control Points (Principle 2); (8) establishing critical limits for Critical Control Points (Principle 3); (9) establishing a procedure for monitoring critical limits (Principle 4); (10) establishing corrective action (Principle 5); (11) establishing procedures for verification that the HACCP system is working correctly (Principle 6); (12) establishing effective record-keeping systems (Principle 7). In total there are 38 main questions to be answered and 306 variables.

Before filling out the questionnaire, the SFC leaders and staff members responsible for answering the questions in the questionnaire were asked for basic information related to the individual and the company. The remaining part of the questionnaire concentrated on instructing the interviewee on how to fill out the questionnaire and send it back to the researcher after two weeks. Interviewing by telephone was also used to edit or improve the quality of the answers, if answers were missing or unclear.

In short, the structure of the questionnaire focuses mainly on supply chain quality management in general and HACCP implementation in particular for current SFCs in the MD. After receiving the completed questionnaires, the data were coded and analyzed. The results can be found in the next section.

3.2 The survey results: general information

3.2.1 Interviewee general information

Thirty-two people representing the 32 SFCs filled out the questionnaires; 75% were male and 25% female. The average age of the interviewees was 37 (minimum 26 and maximum 51). Most of them were heads of quality control

departments (71.9%) and the others were directors and vice directors of the companies. Regarding their educational level, 78.2% of the interviewees held Bachelor's and/or Master's degrees (Appendix 3*).*

3.2.2 Company general information

Thirty-two of the total number of 52 SFCs in the region were interviewed (accounting for 61.3%). The study focused only on 32 SFCs that had a minimum of two years in business. Twenty-eight of the total of 32 exported seafood products, including shrimp. Four companies without shrimp exports answered the questionnaire. Companies interviewed were located in the twelve provinces of the MD. Most of the seafood companies were small-medium size* (71%) and were owned by the State (68.8%). Their average business time was approximately 13 years. The SFCs' product structure included shrimp (87.5%), fish (46.9%) and other seafood products 40.6% (mollusk, cuttlefish). All three kinds of ownerships (SOE, private SFC and Stock SFC) export their products to three main markets (Japan, the US and the EU). Specifically, of the SFCs 87.5% exported products to the US, 78.1% to Japan, 59.4% to the EU, and 25% to Korea. Their main problems, advantages and disadvantages are illustrated in Table 3.1.

Table 3.1 General information about the companies interviewed

Indicator	Total seafood companies interviewed: 32 (100%)		
1. Kind of ownership	SOEs: 65.6%	Private SFCs: 28.1%	Stock SFCs: 6.3%
2. Range of employee	500 - 999: 50%	1000 – 1500: 21%	> 1500: 29%
3. Years in business	Average: 13 years;	Maximum: 50 years;	Minimum: 2 years
4. Profit level in 2001	Low profit: 68.8%	High profit: 21.9%	Break even & loss: 9.4%
5. Main export product	Shrimp and other seafood		
6. Main export market	Japan, EU and the US		
7. Main problems	Infection hazards in the chain		
8. Main advantages	Support from Fisheries Ministry, VASEP and NAFIQAVED		
9. Main disadvantages	Lack of managerial knowledge, technology and equipment		

Source: survey result (Loc, 2002)

(*) According to decree No.91/2001/CP-ND of the Vietnamese government, SMEs "are independent business entities, which have registered their business in accordance with prevailing laws, with registered capital of not more than VND 10 billion or an annual average number of employees of not more than 300 people".

With regard to their business results, most of the SFCs (68.8%) earned over US$2 million, and the remaining 21.9% made between US$1 million and US$2 million profit per year. Major advantages for the SFCs' business operation were stable raw materials and knowledge of quality control by managers. In contrast, they have also faced many difficulties, such as lack of capital, a low level of investment in processing technology as well as in other investments for improving product quality (e.g., limited application of quality standards – HACCP, ISO, etc.). Moreover, knowledge of quality control is at a high level for managers – they are trained by VASEP in general managerial knowledge, quality control management, international quality control standards, etc.; however employees have not been sufficiently trained so far.

3.2.3 Quality management of the interviewed SFCs

3.2.3.1 Leadership

From the data it can be observed that top management itself has actively participated in QC activities as well as in the improvement of quality control management. Top managers are informed by the quality control staff on relevant quality control issues. They are involved in decision-making on all quality control activities in the company, but they are not included on the quality control team. In addition, empowerment of employees to solve quality control problems is limited, as these are only solved by those directly responsible. Regarding quality and yields, 78.1% of the companies have focused more on product quality than on yields. Other data and information relating to leadership is shown in the following table.

Table 3.2 Leadership related to QM of interviewed companies

Statement	% of the answers
1. Top management actively participates in QM* activities	96.9
2. Top management learns quality-related concepts and skills	93.7
3. Top management strongly encourages employee involvement in QM activities	96.9
4. Top management empowers employees to solve quality problems	75.0
5. Top management arranges adequate resources for employee education and training	93.8
6. Top management discusses quality-related issues in top management meetings	93.8
7. Top management focuses on product quality rather than yields	78.1
8. Top management pursues long-term business success	96.9

Source: survey result (Loc, 2002)

3.2.3.2 Supplier quality management

Approximately 93.8% of the SFCs had established long-term good relations with their suppliers and received feedback on the production of the suppliers' shrimp. Nevertheless, 25% of them did not regard shrimp quality as the most

important factor in selecting their suppliers – they also considered other relevant factors, such as management, reputation, loyalty, capital, knowledge, as well as awareness. According to the leaders interviewed, the limitations of the SFCs are that they are not informed about the suppliers' performance in detail and that they do not audit the suppliers' quality regularly.

3.2.3.3 Quality control and improvement in processing

Almost all SFCs (96.9%) are kept neat and clean. Processing capacity has met production requirements. Production equipment is well maintained according to the maintenance plan and various types of inspections have been effectively implemented (e.g., processing and final products).

3.2.3.4 Quality system improvement

The quality standards that the SFCs followed are GMP (93.8%), SSOP (93.8%), TQM (6.2%), ISO (34.4%), SQF (31.3%), BRC (6.3%), and HACCP (96.9%). The TQM and ISO standards are applied to a few large companies because they have enough finance to cover the costs of implementation, while the BRC standard is still very new for them. Of the answers, 87.5% showed that their quality control systems are continuously being improved. Almost all SFCs have a clear quality control manual (90.7%), clear procedural documents (93.8%) and clear working instructions (93.8%).

3.2.3.5 Employee participation

Of the SFCs, 93.8% have cross-functional teams but only 72% of them have several QC circles (within one function). However, there is only a small percentage of employees who are actively involved in quality control-related activities. Their suggestions are only listened to by mid-level top management because of the employees' low level of education and knowledge of quality control.

3.2.3.6 Education and training

The interviewees mentioned that their employees were encouraged to seek education and training on quality control management and specific work skills, free of charge. However, only a small percentage of them were trained on how to use quality control management tools because the companies only focus on the managers at each processing point.

3.2.3.7 Customer focus

All of the interviewed companies have had extensive complaint information from customers. Quality control related customer complaints are treated with top priority because of the warranty provided to customers on their products, and so the companies have been customer oriented for a long time. However, the SFCs

could not conduct customer surveys every year or perform market research in order to gather suggestions for product improvement due to a lack of financial means and marketing research experience. They have received customer information from the import companies or agencies in Vietnam who order the shrimp products. As a result, the companies sometimes found themselves in difficulties when satisfying customer demands as to product quality during production and processing because customers seemed to be continuously changing their consumption behaviour.

3.3 The role of the government and industry

Along with the main survey of SFCs in the MD, unstructured interviews of local government agencies (Department of Fisheries, Extension Centre, Department of Agriculture and support organizations (VASEP and NAFIQUAVED) were conducted. According to them, seafood safety and quality in general, and shrimp in particular, cannot be free from hazards without a contribution by government and industry. Because HACCP has not been implemented in primary production, or in other issues regarding seafood supply chain safety and quality, the role of government and industry is vital. The following figure shows the managerial structure and process for the Fisheries Ministry as related to fishery safety and protection. The Department of Science & Technology plays an important role in fishery research, which helps the Ministry of Fisheries to issue suitable policies for sustainable development and environmental protection. In addition, the department provides information and new techniques, including culture techniques, exploitable techniques and processing techniques, to the agricultural departments of local governments. The Department of Fisheries Resource Development and Protection (FRDP) and NAFIQAVED help the Ministry of Fisheries issue the appropriate policies and regulations regarding food safety and quality management. They also expand and inspect national quality assurance programs at the local government level. Along with NAFIQAVED, VASEP is also a support organization for SFCs in various ways. Both the roles of management and the support of VASEP and NAFIQAVED are dealt with in detail in Chapter 1, Section 1.2.1. Generally speaking, the Ministry of Fisheries and local governments together manage the operation of SFCs.

The Ministry of Fisheries is the highest authority for the issuance of all decrees and regulations in the fields of food safety and quality, environmental protection, fisheries resource development and protection, veterinary drug use and production, and training on food safety and quality. At the local government level, the Department of Fisheries is responsible for implementing and expanding the decrees and regulations to other relevant departments, lower management authority, SFCs, and farmers, as well as receiving their feedback.

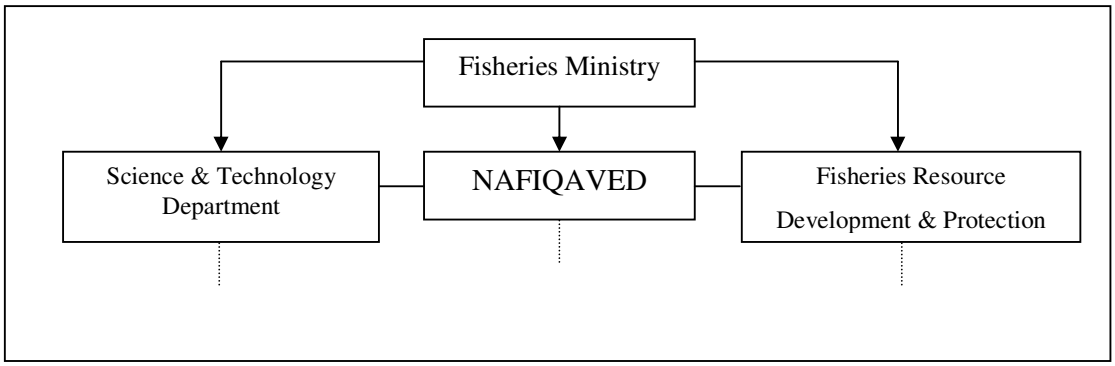


Figure 3.2 Managerial structure of the Fisheries Ministry regarding fishery safety and protection

At the present time, the Vietnamese government continues to encourage and promote appropriate and practical policies and programs for developing the fisheries industry. In other words, the government has implemented programs that are effective for food safety and quality in general and seafood in particular throughout the whole chain. The government also deals with feed production – ingredients in feed must ensure the growth of fisheries in general, and shrimp in particular, free from banned residues. In addition, the inspection of HACCP implementation in the companies should be conducted and audited by the VASEP and NAFIQAVED frequently in order to ensure that the procedures and principles of HACCP and prerequisite programs are applied completely and effectively at the company level (Ministry of Fisheries, 2003).

The role of the government and industry, as well as that of support organizations, will be discussed in detail below for each stage of the chain.

3.4 Shrimp supply chain quality issues and resulting discussion in the MD

The shrimp supply chain in the MD as shown in the following figure includes five stages – hatchery, farm/capture, collector/wholesale buyers, the SFCs and distribution. HACCP should have been applied at all stages of the chain, but only the SFCs in the chain have implemented the HACCP, according to the survey results of 32 SFCs in the MD. Other stages of the chain are given support by the Vietnamese government in order to improve and ensure seafood quality and safety. As a result, approximately 38% of the interviewed companies had their products refused by customers due to antibiotic infection (choramphenicol) and other contaminants in 2002. Moreover, in 2003 Vietnam's seafood had weekly warnings from the US and EU markets due to infection by contaminants.

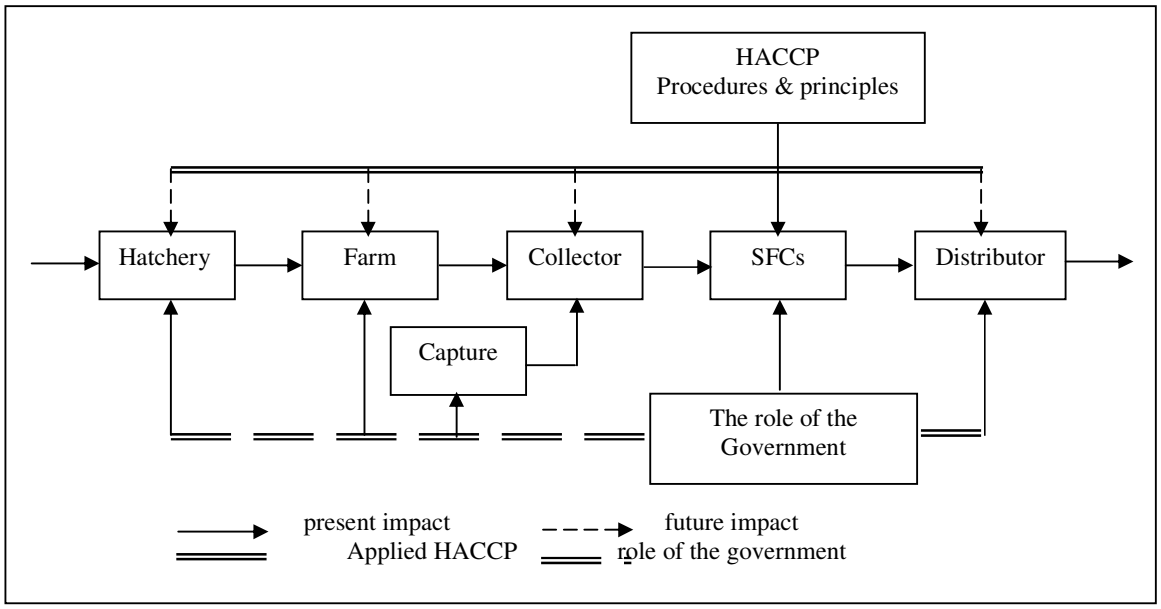


Figure 3.3 The HACCP and the role of government in the shrimp chain in the MD

Regarding hazards which have occurred throughout the chain, 25% of the companies said that their products were infected by microbiological hazards (E.coli, coliform, and salmonella). Similarly, 15.6% and 9.4% answered that the products were infected by chemical (Cloramphenicol and sullfit) and physical hazards (pieces of metal), respectively. More specifically, although the companies have good control over the temperature and the hygiene of the equipment in the shrimp purchasing process, they could not control or audit the level of antibiotic infection or the ice hygiene, although they have good relations with the suppliers. Both the company and suppliers lack equipment to uncover these hazards. In processing, almost all SFCs (96.9%) have controlled those hazards active in shrimp procedures – shrimp material receiving, handling, classification, frame, freeze, ice-plated, metal check, packaging and storage. The following will detail the issues of shrimp supply chain quality in the MD.

3.4.1 Hatchery production

Almost all 900 hatcheries in the MD are of small-medium size (two-thirds) and are managed under private ownership (95%). The hatcheries' activities are simple – low construction and operation costs, and low technical input. The operation is flexible, depending on the season and supply of wild seed. This type of hatchery often has disease and water quality problems, but they are easily and quickly disinfected and re-opened without serious losses. Some hatcheries use large tanks, low stocking densities, and low rates of water exchange. These issues lead to difficulty for governmental support organizations to give helps in

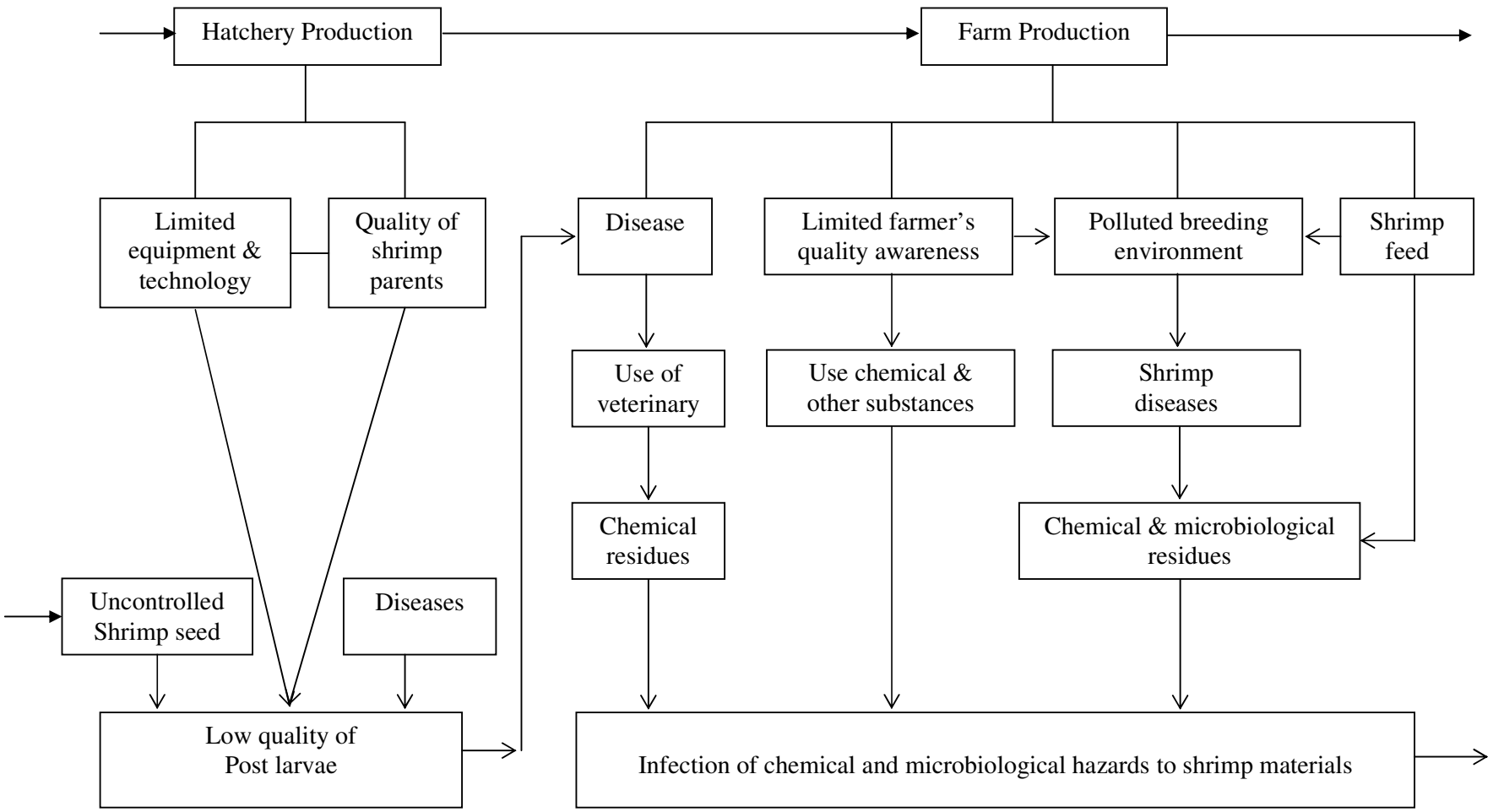
seed quality and safe assurance due to tattered production without control (Sinh, 2002).

According to the research by Sinh (2002), since the beginning of the 1990s shrimp propagation research in the MD has focused on the maturation of P. monodon broodstock, which is considered the bottleneck for shrimp hatcheries and farming in the MD. Artificial *P.* monodon post larvae were imported from the Central region to overcome this bottleneck. The import of post larvae from the Central region has thus been a major source of shrimp seed for grow-out activities in the region. About 900 hatcheries in the MD provided 3,877 million post larvae, which equals 18.9% of the total demand for shrimp seed purchased by the shrimp grow-out farms in the region. According to the provincial Departments of Fisheries Source Protection, approximately 20%-50% of total shrimp seed sold in the market are inspected at their source for disease. However, the inspection is simple – done visually – so low quality shrimp seed from uncontrolled sources is common in the region. This has affected shrimp yield and quality at the farm (Figure 3.4).

In order to better manage the shrimp seed, there have been several regulations and government policies concerning hatchery development in order to provide high shrimp seed quality and quantity, but these have had minimal effect. For example, regulations for the protection and conservation of natural aquatic sources were issued by the Ministry of Fisheries in 1987. The regulations on the production of shrimp seed and on nurseries for post larvae from PL12 to PL35-45 have been implemented since 1998 (Ministry of Fisheries, 1998). However, the management of post larvae quality and trading has not been improved. A lack of 'high-tech' checking methods and facilities is associated with those problems caused by the special transportation network involved (Ministry of Fisheries, 2000-2003).

As a result, policies and regulations set by the government have been changed so as to accept the import of shrimp broodstock and shrimp seed from neighbouring countries. In 2002, a total of 10,919 shrimp broodstock were imported from Singapore, China, Myanmar and Australia. However, 2,668 shrimp died immediately upon reaching Vietnam for various reasons. Import of a diversity of shrimp species is being given consideration along with the import and artificial propagation of *Penaneus vanamei*. Starting in 2003, the production of about 3 billion post larvae of this species is expected per year, of which 2 billion in the Central Region, and 1 billion in the MD (Ministry of Fisheries, 2003). The demand for shrimp seed may vary for many reasons. The changes in the international market for shrimp products is particularly variable, and the level of intensification of shrimp farm development, as well as the success of both shrimp seed production and breeding activities, can change rapidly over time.

Figure 3.4 Shrimp problems in hatchery and farm productions



The Ministry of Fisheries (2001) explained that at the beginning of 2001, around 110,000 hectares of rice fields were converted into rice-shrimp areas in the coastal provinces of the region, mainly in Ca Mau, Bac Lieu, Soc Trang, and Kien Giang provinces. But shrimp crop losses were observed in 50%-70% of these areas in the first crop of the year with about 3 billion shrimp seed being washed away. This was thought to be a result of the low level of shrimp seed quality and lack of technical skills, in addition to possibly unsuitable conditions in the new ponds. The large increase in the culture areas and the big loss of shrimp seed has raised the demand for shrimp seed. This has increased the risk in shrimp production, since pressure is placed on the quantity and quality of the shrimp seed supplied. At the same time, the development of the shrimp industry is strongly dependent on the quantity and quality of the shrimp seed supplied. Many attempts have been made by different institutions to improve both shrimp seed production and grow-out, but the results are still varied and risky.

In short, the improvement of the quality of larvae depends on the quality and the reproductive capacity of the shrimp broodstock, and on a number of other factors relating to the stocking of broodstock and the rearing of larvae in the shrimp hatcheries. In addition, quality control knowledge and hatchery staff responsibility are still limited. Several methods have been designed to check the quality of post larvae before buying and stocking them into the breeding ponds. Quality testing of post larvae using the Polymerase Chain Reaction Method (the PCR test) has become very important for intensive breeding farms along with the government's support in management and quality control assurance of shrimp seed.

3.4.2 Farm production

There are three typical practices of shrimp grow-out farming in Vietnam and in the MD (Appendix 5). These three farming systems – extensive, semi-intensive and intensive systems – were applied to 80%, 15% and 5% of the total shrimp culture areas in 1995 (Rosenberry, 1996). The Ministry of Fisheries (2000) showed that these percentages were similar in 2000 – 81.2%, 17.5%, and 1.3%, respectively. Currently, the integration of mangrove-shrimp and rice-shrimp farming, and improved extensive mono shrimp practices are common in the MD.

The farmers who produce shrimp materials to sell to the SFCs include two groups – free farmers (their shrimp sold to the collectors) and fixed farmers (their shrimp bought, where produced, by the SFCs). All farmers are supported by provincial extension centres where farmers can be instructed in shrimp breeding techniques. However, the SFCs cannot ensure the quality of shrimp product from both free and fixed farmers because shrimp quality is affected by many factors beside culture techniques, factors such as shrimp feed, veterinary drugs and environmental hygiene. These issues are not the responsibility of the

extension centres. In contrast, fixed farmers (21.5%) include both the farmers who regularly sell their shrimps independently to the SFCs and the farmers set up by the company. Although bred shrimp from fixed farmers are monitored by extension staff or technicians or both, hazards cannot be completely eliminated from products because the staff/technicians do not check for diseases of shrimp seed, banned residues in shrimp feed and veterinary techniques. In addition, a polluted breeding environment and farmers who have only a limited awareness of quality control are major factors which cause chemical hazards in shrimp materials either directly or indirectly (Figure 3.4).

Shrimp disease outbreaks in the MD have been occurring since the end of 1993, due to many factors. The main causes are lack of suitable planning; low levels of technical and farm management knowledge; degradation of the environment, especially water quality and deforestation of the mangrove forest; and a poor supply of shrimp seed in terms of both quantity and quality. For the period 1994-1999, only 20-30% of farms were successful in shrimp culture (Truong and Tham, 1996; Ministry of Fisheries, 1995, 1997, 1999 and 2000; Sinh and Binh, 1996). We remind that at the beginning of 2001, about 110,000 hectares of rice fields in Soc Trang, Bac Lieu and Ca Mau provinces were converted into rice-shrimp areas, but 50-70% of these areas lost the first crop of the year. Shrimp production has become a sector with high levels of risk. In order to obtain more satisfactory outcomes, a number of things need to be improved, especially a better supply of shrimp seed in terms of quantity, quality, and the timing of supply. Many experiments have been conducted, including studies on the diversity of species, but the results have not been clear and production remains risky. In 2002, diseases occurred on 74,128 hectares, accounting for 27.6% of the total cultured areas (Ministry of Fisheries, 2001-2003). As a result, lots of different antibiotic and other medicines used have affected the quality of raw shrimp materials.

In addition, in recent years the Vietnamese government has played an important role in encouraging and promoting quality control in seafood products, from primary production to distribution. In primary production, the government has issued a great many policy directives and regulations related to fisheries safety and hygiene, environmental protection, fisheries development in terms of development of culture areas, the level of antibiotic usage, as well as veterinary drugs and other medicines for fishery safety. However, the effectiveness of these policies and regulations has not been evaluated at a high level because the implementation of policies and governmental programs by local governments is not being synchronously monitored by the Department of Fisheries, Department of Agriculture and Rural Development throughout the provinces of the MD. Nowadays, the role of extension training is very important in the field of support for farmers in breeding techniques, protection of the breeding environment, even in propagation of the government's policies and decrees as related to fishery

safety and sustainable development, and implementation of instructions. Nevertheless, demand for extension staff in the MD now exceeds supply in terms of quantity and quality. At present, the number of experienced staff is very limited, and this does not meet the requirements for fishery development.

According to the opinions of interviewees, their business success has so far resulted from good quality control and stable sources of shrimp materials – from fixed agents and farmers (93.8%) and from their own investment (46.9%). Nowadays, some large SFCs use their capital to invest in shrimp or fish breeding for farmers. In addition, they also participate in quality control management by providing technicians to observe and control as well as guide the farmers on how to manage the quality of shrimp materials. However, approximately 38% of the interviewed companies had products that were refused by customers due to antibiotic infection (choramphenicol) and other contaminants.

3.4.3 Catching activities

Regarding the marine catch of fisheries, after a period of rapid growth in the late 1980s and early 1990s, the fishing industry experienced a downturn due to sagging efficiency: the yield of fishing boats, which was on average 0.92 ton/horsepower in 1990, fell to 0.62 ton/horsepower. This was due to objective factors (inshore fishing has exceeded the norm of permissible catch by 10%) and subjective factors (backward machinery and equipment, lack of means and experience in high sea fishing, poor qualifications of the work force). In recent years, all offshore fishermen have been supported by a loan concessionary policy for equipment and boat investment in order to increase productivity but the loan amount is still limited. Also, the offshore fishermen lack the techniques and equipment for the storage of raw materials. More specifically, although offshore shrimp materials are seldom infected by hazards, storage techniques and equipment, lack of quality control knowledge, as well as a long storage time offshore (about 7 days), are the main factors affecting shrimp materials.

3.4.4 Collector/Wholesale buyer

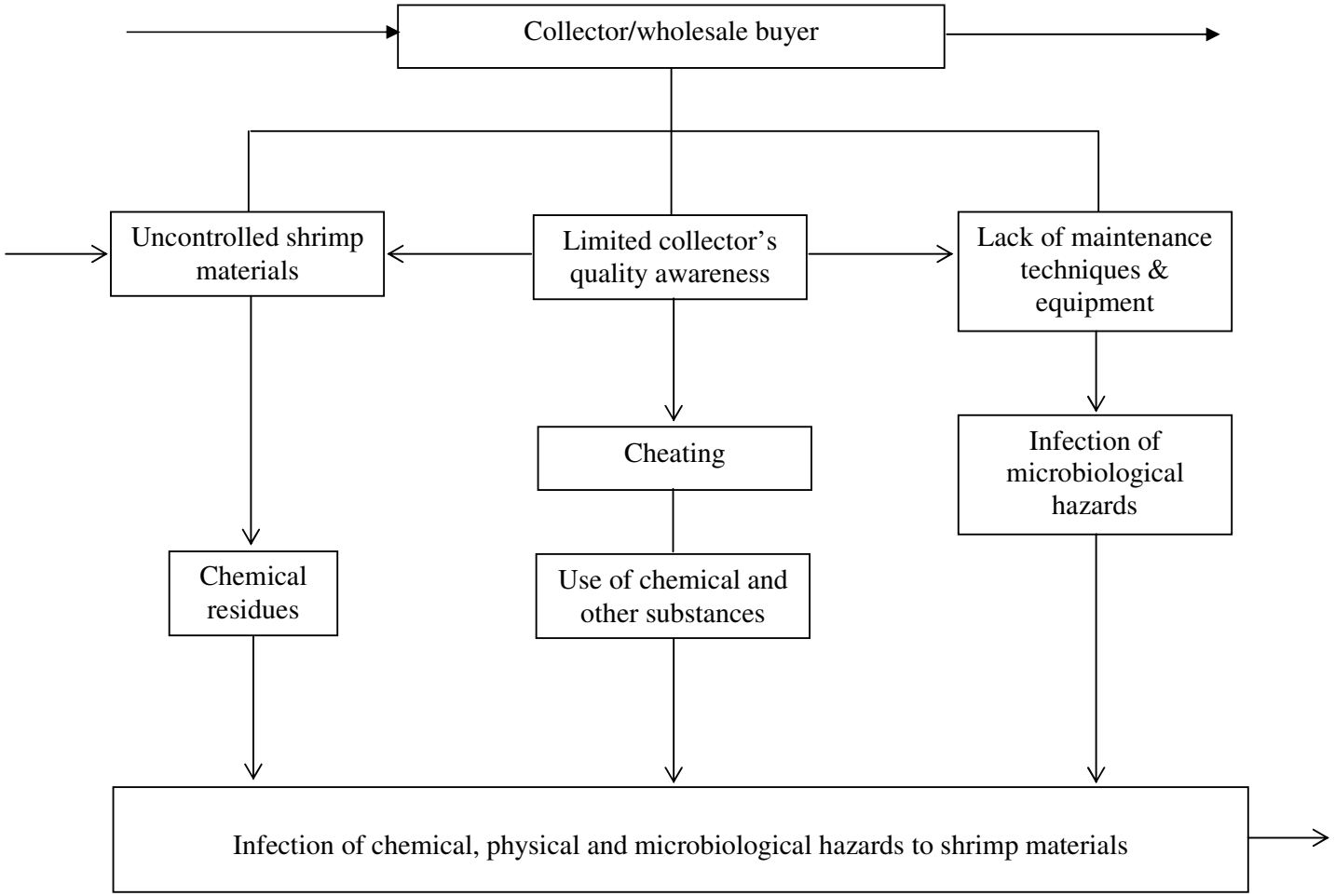
According to the survey of SFCs, approximately 61.8% of the input shrimp materials of the SFCs are bought from collectors. Collectors' activities are simple – buying, storing and transporting shrimp for the SFCs (which takes a maximum 3 days), but they are the ones affecting shrimp quality according to the SFC leaders interviewed. Capital, maintenance techniques and means are the main factors in the collectors' activities. Collectors' capital used to buy shrimp materials comes from three sources – from collectors themselves, from loans and from the SFCs. Some SFCs can provide money in advance to collectors in order to buy shrimp materials (one of the methods for ensuring collectors' loyalty to the companies). In addition, the supplier's own conditions themselves are limited – lack of capital, quality awareness and equipment for inspecting and maintaining shrimp materials, as well as low educational levels in understanding

and applying quality control knowledge. In particular, they do not understand the importance of quality control in final products traded in the world market. They have even used banned chemicals and other substances in maintaining shrimp materials before selling them to the SFCs (Figure 3.5). Regarding the inspection of shrimp input, both the company and the collectors only use visual controls to inspect shrimp materials, which are of course, an insufficient means for uncovering hazards. According to interviewed SFCs, they were most concerned with the quality requirements of shrimp materials because approximately 56.3% of the total shrimp materials was assessed as being of good quality, and this was thanks to a good supply of shrimp.

The collectors themselves are the main factor affecting the quality of shrimp. They inject chemical substances, edible seaweed, shrimp meat or nails to add to shrimp size and weight before transporting them to the companies. In addition, there is intense competition in buying raw shrimp in the MD for the supply of raw shrimp to the SFCs in the region and outside the region. In point of fact, SFCs in the MD themselves have used various policies to safeguard collector's loyalty and shrimp quality, especially by promoting a pricing policy and advance payment. Therefore, in order to improve the collector's shrimp quality, the SFCs play a very important role in terms of instruction in maintenance techniques, quality control awareness, even participating in the collector's own operations in terms of auditing and inspecting shrimp material. Also, it is necessary to maintain support from the government, both for loan service and in implementing severe punishment for collectors who cheat.

In short, nobody (the government, the extension centre, the farmers, the collectors or the companies) can ensure 100% quality in shrimp materials, keeping them free from the disease, hazards and other contaminants, when even shrimp controlled strictly by the company fall short due to uncontrollable hazards from shrimp seed, feed and veterinary drug use.

Figure 3.5 Shrimp problems at the collector/wholesale buyer stage

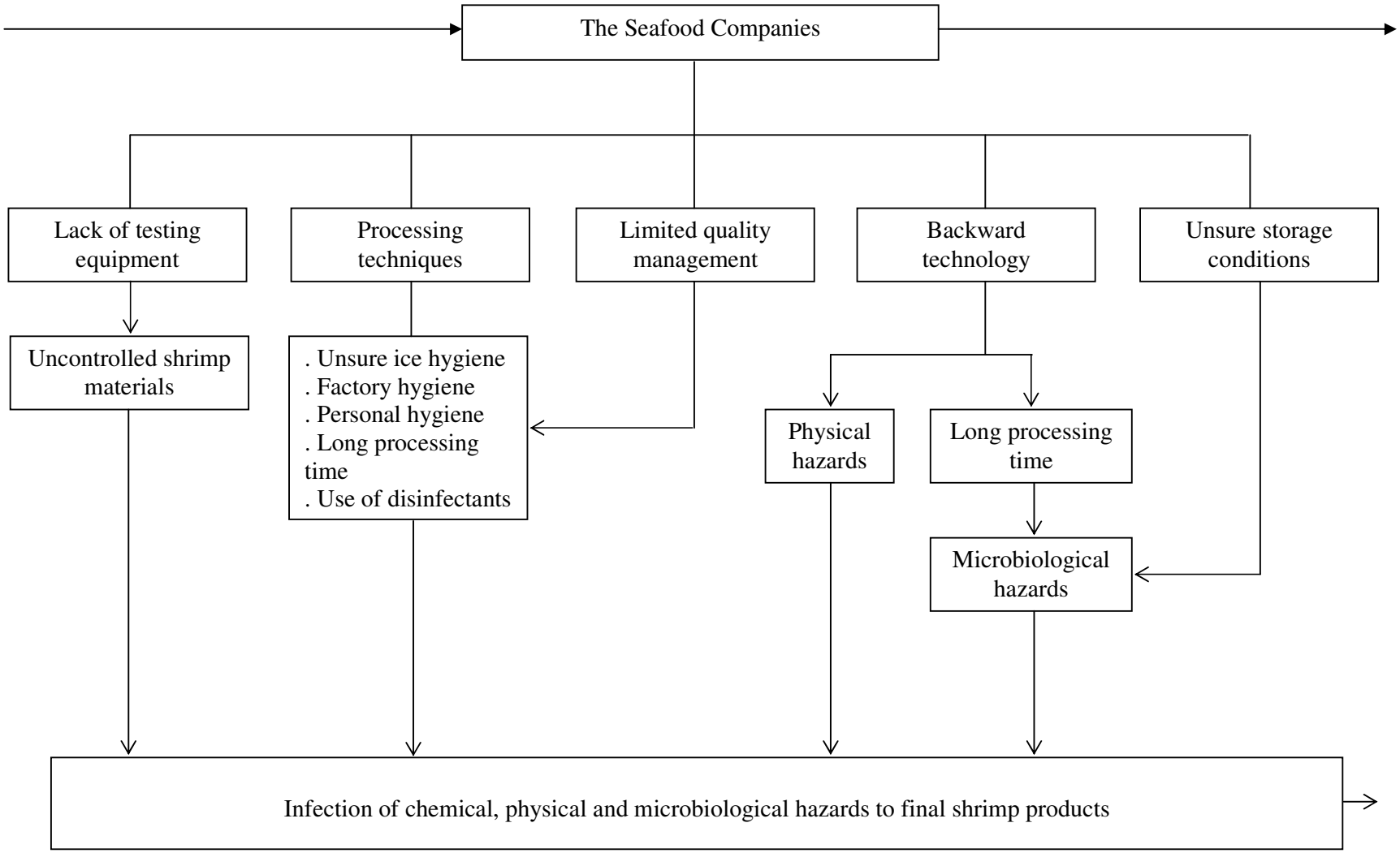


3.4.5 Manufacturing process

Generally speaking, the companies did not satisfy quality requirements for shrimp materials. On the one hand, this was due to the fact that their plants are located far from the sources of shrimp materials. On the other hand, there are not enough control conditions set up for quality control of shrimp materials. The SFCs realized that the quality of shrimp materials is a very important factor that affects the quality of the finished product. In addition, a company's reputation in terms of business success and flexible policies on price (43.8%), and quick payment (50%) are important elements that the SFCs use to maintain suppliers' loyalty. Moreover, almost all SFCs in the MD have to compete fiercely in buying shrimp materials with both internal and external SFCs in the region (93.8%). As a result, uncontrolled shrimp materials are still being regularly distributed in the MD.

During the shrimp processing procedure, hazards can occur at any stage from receiving input shrimp to the distribution phase. According to the interviewees, the factors that affected the final shrimp quality in processes are (1) quality of shrimp materials (81.3%); (2) storage process (50%); (3) processing technology (56.3%); (4) processing techniques (68.6%) and (5) inventory time of finished products (53.1%). To keep final shrimp products free from hazards and to ensure hygiene, safety and quality, HACCP procedures and principles are a crucial tool. At present, the SFCs in the MD have implemented prerequisite programs before applying the HACCP, such as GMP and SSOP, as well as other methods related to initial changes in management and human resources, needing to be adapted to their specific conditions. However, according to the survey results, although 96.9% of the SFCs applied the procedures and principles of HACCP, they have not been completely implemented inside the company. The reasons for this are a lack of capital to invest in modern technology and testing equipment; a lack of experts or specialists with high capabilities and skills in quality management, supply chain management and statistical knowledge; the low level of employee quality control awareness; and the intransigence of quality control behavior. Also, as we have seen other international standards have hardly been applied at all – only 6.2%, 34.4%, 31.3% and 6.3% for application of TQM, ISO, SQF and BRC, respectively. As a result, final shrimp products are still not completely free from hazards (Figure 3.6).

Figure 3.6 Shrimp problems in the manufacturing process



Almost all companies in the MD (96.9%) have established an HACCP team. Adapted to the organizational structure of each company, each team includes a quality control specialist (78.1%), a production specialist (71.9%), an engineer (71.9%), a member of the management (43.8%), and one other specialist (buyers, operators, packaging experts, distribution experts, or hygiene managers). It is the responsibility of the team to describe the product and its distribution, elements such as the composition and physical features of the final product (87.5%), processing information (production methods used – 81.3%), method of packaging (78.1%), required shelf life (87.5%), storage and distribution conditions along the chain (81.3%), legislative product requirements (71.9%), and instructions for use and storage by consumers (68.8%). In addition, 87.5% of the companies have developed process flow diagrams.

Table 3.3 shows indicators regarding setting flow diagrams conducted by SFCs. This result indicates that SFCs in the MD have not sufficiently implemented data collection and saved enough of it in order to develop process flow diagrams. On the one hand, the statistical knowledge of the staff is limited. On the other hand, the development of process flow diagrams in some cases, according to HACCP managers, is not deemed necessary.

Table 3.3 Data set for flow diagrams of SFCs

Indicators	(%) of SFCs applied
1. All raw materials/ingredients and packaging used	65.6
2. Time/temperature history of the chain	71.9
3. Process conditions	68.8
4. Storage and distribution conditions	68.8
5. Product loops for recycling or rework	37.5
6. Routes of potential cross-contamination	62.5
7. High/low risk area segregation	62.5
8. Overview of floors and a layout of equipment	62.5
9. Features of equipment design	46.9
10. Efficacy of cleaning and disinfection procedures	65.6
11. Personal hygiene practices	75.0
12. Consumer-use instructions	65.6
13. Inspected the process and verified the flow diagrams	87.5

Source: Survey result (Loc, 2002; Appendices 6 & 7)

Regarding Critical Control Points (CCPs) mentioned in Table 3.4, only 71.9% of the SFCs use the CCP to check input shrimp materials, 59.4% concentrate on shrimp processing, and 56.3% on the packaging process. The reasons for determining CCPs are that hazards have often occurred during these processes. In addition, the companies have also established critical limits for these CCPs – 71.9% of the SFCs have established critical limits to control microbiological hazards, similarly, 84.4% and 81.3% for chemical and physical limits, respectively. In point of fact, the companies have very simple procedures for monitoring critical limits – they do not have clear procedures as to "what to monitor, why to monitor, how to monitor, where to monitor, who monitors, and when to monitor?" Moreover, the procedure is most often managed by one quality control head who cannot observe the whole process at the same time. As a result, corrective actions after monitoring were only concentrated on a few of the main processes.

Table 3.4 The percentage of SFCs that have established CCPs

Contents	% of SFCs that determined CCPs
1. Purchase of raw materials	71.9
2. Shrimp material receiving and handling	43.8
3. Shrimp processing	59.4
4. Packaging	56.3
5. Storage	18.8
6. Distribution	3.10

Source: Survey result (Loc, 2002)

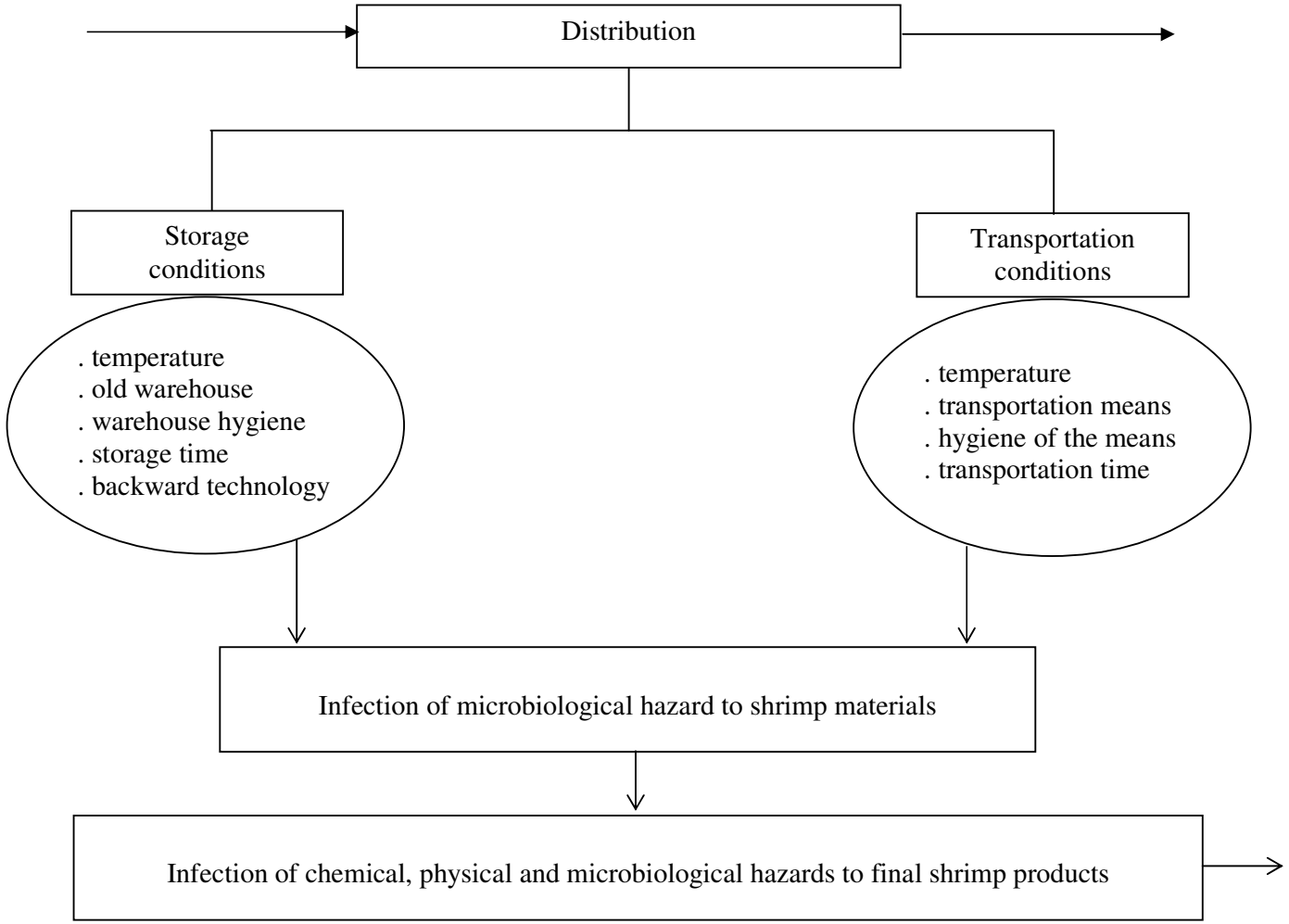
In addition, most of the interviewed companies have in fact established effective record-keeping systems, such as CCP records (96.9%), critical limit records (96.9%), records associated with deviations (90.6%), records and verification (100%), records review and retention (90.6%), and regulatory access (93.8%). The extent to which the HACCP system was working correctly depended very much on the conditions in each company. The results of the interviews showed that 81.3% of the SFCs have applied some prevention procedure, CCP verification (87.5%), and HACCP program verification (87.5%).

3.4.6 Distribution stage

As far as quality control in distribution is concerned, the company can only implement quality assurance in the storage and transportation stages in the chain inside the company because these can be managed and controlled directly by the company itself. However, storage conditions are generally not strong or safe enough to keep up with the quantity and quality (temperature, old warehouses and technology) of the products. According to the primary data, the quality of shrimp final products was affected by storage conditions (50%), inventory time (53.1%), and transportation conditions (40.6%) (Figure 3.7). Other stages, such as selling and receiving orders, transportation and storage outside the company, buying and consumer usage, have not been handled by the company as they lay beyond the company's control. Moreover, so far the company only gets customer complaints from external foreign agencies, and not from market information and analysis.

As in other stages of the chain, during the distribution process the government has provided support by acting as interlocutor to help the SFCs with troubles related to customs formalities, as well as giving the SFCs' one voice in import market problems regarding quality standard levels, product label, and product devaluation. But the effectiveness of this support is still limited because of the companies' lack of knowledge and experience in international business negotiation and business conflict cases.

Figure 3.7 Shrimp problems in Distribution stage



3.5 The supply chain deficiencies in shrimp quality assurance

At the company level, the survey results showed some supply chain deficiencies (D) in quality assurance that affect final shrimp products (Figure 3.8). As for the first deficiency, SFC management has no influence on hatchery management, hence it cannot participate in any quality control of shrimp seed supplied to the farmers. The quality of shrimp seed completely depends on conditions within the hatcheries themselves and on State regulations and management including NAFIQAVED support on testing shrimp seed quality. Deficiency 1 cannot be solved by the SFCs at present or in the near future because of managerial and technological conditions.

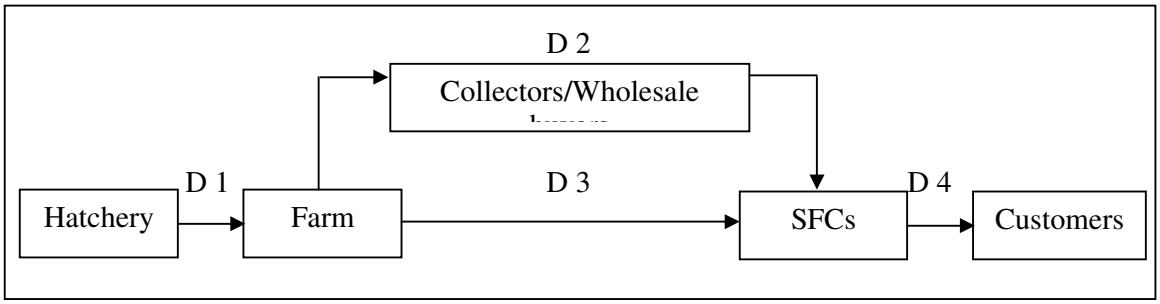


Figure 3.8 Supply chain deficiencies in shrimp quality assurance

In addition, the SFCs cannot control the quality of shrimp materials delivered from the farmers to the company via the collectors/wholesale buyers because it would take too much time and expense to control such vast areas of shrimp culture. Moreover, the companies cannot manage breeding techniques at the farmer level and feed quality at the feed wholesaler level.

Deficiency 2: wholesale buyers/collectors themselves do not have optimal conditions in the fields of quality and technical knowledge, or sufficient capital to help the farmers guarantee shrimp quality. So far, the companies have not put any effort into stimulating wholesale buyers/collectors to improve their shrimp materials. Deficiency 2 affects the quality of shrimp materials outside the company the most because most of the shrimp materials are sold to the SFCs through this channel.

Deficiency 3: although the companies can partly participate in quality assurance of shrimp materials at the farmer level when the company invests in the farm, they cannot also manage the farmer's feed quality and veterinary drugs used during breeding time.

Deficiency 4: The SFC only has knowledge of customer information and requirements from import companies and agencies or from other companies or from common communication sources, such as websites, magazines and newspapers. The specific indicators on technical barriers to trade and sanitation performance standards are very strict in international business. Moreover, import nations always use modern equipment to inspect and discover hazards from seafood products in the lowest level, while the SFCs and NAFIQAVED are unable to eliminate those hazards before export, due to an incomplete program of quality assurance (e.g. HACCP application) and modern equipment shortage.

Generally speaking, to correct shrimp supply chain deficiencies it is necessary to enhance the role of the government in State management of quality, hygiene, veterinary drugs and feed in fishery production, as well as the role of organization and management within the hatcheries themselves. Likewise, it is necessary to enhance the support of VASEP and NAFIQAVED in quality training, inspection and international negotiation.

Moreover, emphasizing the role and responsibilities of the SFCs in the domain of quality improvement not only within the companies (manufacturing process) themselves, but also with their suppliers through supplier quality management is very important. The SFCs should establish a bridge between their quality requirements and the activities of their chain stakeholders, as well as with local governments (provincial agricultural departments). The SFCs and local governments should join forces to guarantee shrimp quality and improve quality throughout the whole chain. In addition, the companies need to enhance quality improvement and assurance (the HACCP programs) inside the company, in addition to making technological improvements, enhancing managerial knowledge and skills, as well as improving organizational behaviour in quality control.

Briefly, although the SFCs are supported by the government in terms of priority for capital loans to invest in modern processing technology and equipment, along with VASEP and NAFIQAVED support in quality education and training, market information and inspection of final products before exporting, the SFCs are still getting their information on hazard infection after the fact from import markets like EU and the US. In reality, along with support from the government the SFCs need to implement and follow HACCP programs as well as other standards in order to improve their final products just in order to meet market requirements and expectations. However, the HACCP standard cannot be applied at the primary production and supplier level in the MD any time soon due to limiting conditions in companies, suppliers and farmers themselves. The company is only able to use appropriate policies and knowledge of supplier quality management in order to encourage and promote supplier loyalty and quality assurance. Similarly, the SFCs are unable in the next few years to

manage and control the distribution stage from port to consumer due to the companies' limited expertise in market research, and due to the fact that agencies are responsible for the distribution of the products to end customers.

3.6 Summary

The present chapter summarizes the survey procedure and results of the SFC status quo in the MD. They comprise the supply chain seafood problems in general and shrimp product in particular, from hatchery production to distribution, quality management and HACCP implementation in the SFCs, and the role of government and industry in ensuring food safety and quality. All data and information compiled were collected by structured/unstructured interviews and the questionnaire. This data and information are one of the main bases for developing a seafood supply chain quality control management framework. The next chapter will introduce the framework for improving and assuring safety and quality in the seafood in general and shrimp supply chain in the MD in particular.

Chapter 4

Supply Chain Quality Management Framework

This chapter presents the supply chain quality management framework. It includes seafood quality management measures in primary production and in SFC. The basis for developing the supply chain quality management framework is the structure that is already used in Chapter 3 to describe the problems. What is important here is the distinction between intra-SFC activities and chain activities. Because of the close link with the manufacturing management, we include the distribution stage in the intra-SFC part of the framework. The description structure of Chapter 3 is presented in Figures 3.4-3.7. Figures 3.4 and 3.5 show the problems in and between hatcheries and farms. Figures 3.6 and 3.7 show the problems in manufacturing and distribution.

In addition, the literature is used to help formulate the relevant quality improvement aspects in the various links of the chain and in the intra-SFC processes. The results of the survey help us to be more concrete here. The structured description of the problems also leads to the formulation of measures to improve quality – in primary production, within the SFCs (processing stage), and in the distribution stage. The role of the government as well as the support of the local government, the fisheries industry, VASEP and NAFIQAVED is crucial to the quality and safety of seafood throughout the chain. Therefore, this role has to be taken into account in the framework.

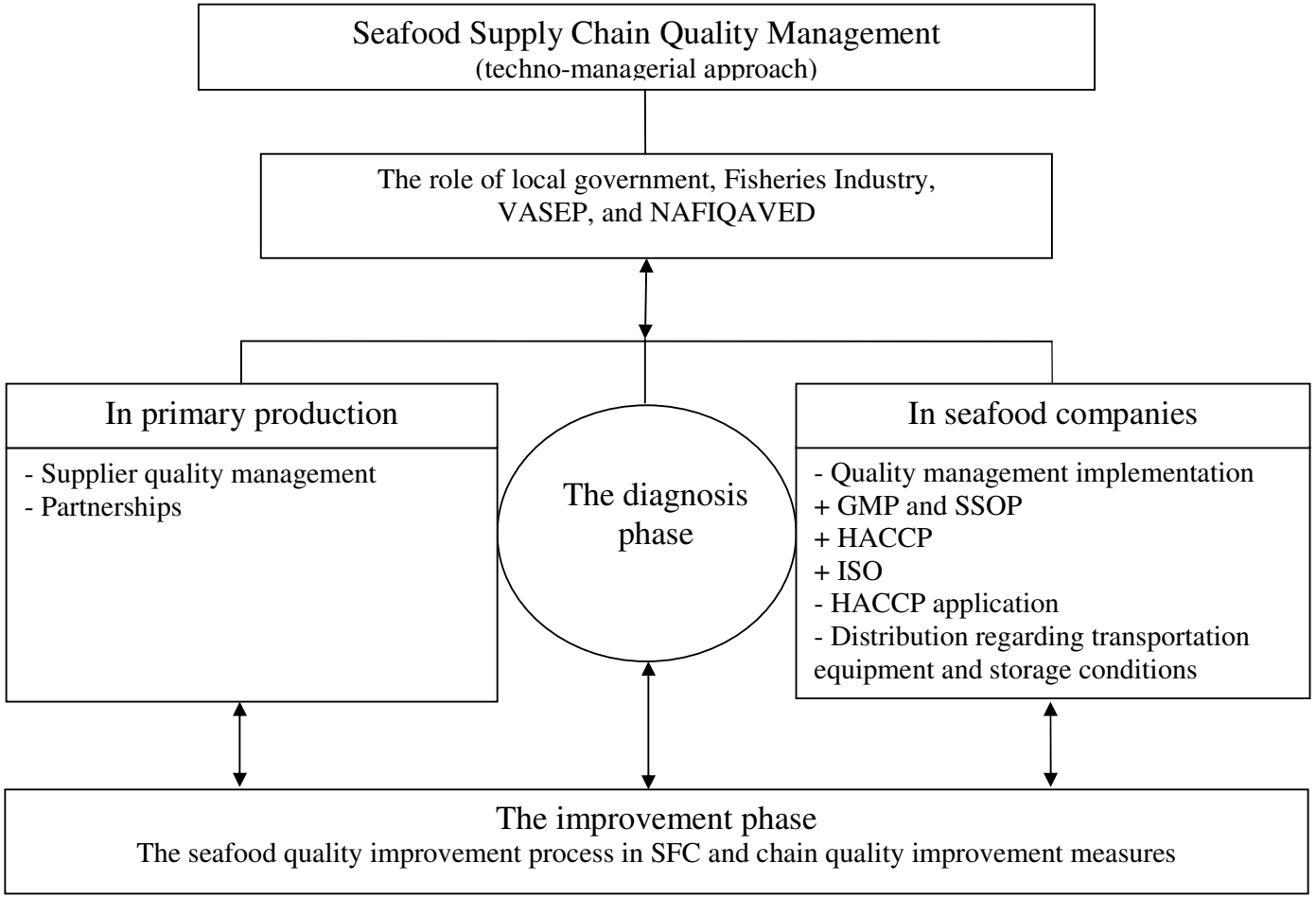
Also, developing the framework is based on the techno-managerial approach, which works interactively from both a technological and managerial viewpoint (Figure 2.1). The reason for using this approach is that at each stage of the chain, especially in the SFC**,** restrictions presently faced are of a technological and a managerial nature. At the SFC level, the adequate development and application of an HACCP system is crucial. This is covered in detail, as are management, technology and organizational behaviour in the two case studies of Chapter 5.

In the present chapter, the SCQM framework will be explained. Figure 1 gives a total picture of the framework. Section 4.1 considers the quality and safety assurance in primary production. Section 4.2 discusses quality management in the SFCs (the processing stage) and at the distribution stage. During the processing stage the emphasis is on HACCP. Measures for improvement – within the SFC and its chain – are considered in Chapter 6.

4.1 Shrimp quality and safety in primary production

Chain stakeholders in shrimp primary production in Vietnam in general and in the MD in particular include hatcheries, farms, collectors, and wholesale buyers. They produce and supply shrimp materials to the SFCs. In order to ensure product quality and safety, HACCP and prerequisite programs must be applied to all SFCs. HACCP and these prerequisite programs deal with the preparation, processing, handling, packaging, and transport and/or trade in shrimp products. Although HACCP is also suitable for primary production, it is not yet applied in the MD due to financial, technological and managerial circumstances. The description structure of Chapter 3, presented in Figures 3.4 and 3.5, helps to show and discuss the problems. The structure includes the role of hatcheries, farms, collectors, and wholesale buyers. The results of the survey of Chapter 3 show that supplier quality management and partnerships with suppliers are required to show improvement. Given the role of government institutes and support organizations, it is also important to establish an adequate relationship with these organizations under the main role of NAFIQAVED.

Figure 4.1 Seafood Supply Chain Quality Management Framework



4.1.1 The role of government institutes, industry and support organizations

The MD's shrimp chain characteristics during primary production are different from those of other products like fish, vegetables and animals. On the one hand, shrimp is cultured in very large quantities throughout the whole region and it is consequently easy for disease to spread throughout the entire stock of shrimp. On the other hand, it is difficult to impart knowledge of quality control to the farmers because they have a low level of education and they lack the capital and the equipment to control the hazards. Therefore, in order to improve the product quality of primary producers in both hatchery and farm, a combination of management by the State and greater responsibility by the hatcheries and farms is vital. The government needs not only to issue policies and regulations in terms of shrimp seed quality control, environmental and fishery hygiene and safety, but also needs to plan large hatcheries and farms for effective management and control objectives. So far, the Vietnamese government has issued a great many policies/decrees and has established national programs to protect the environment. Such programs include the control of pesticide residues, veterinary drugs and other antibiotics to ensure the safety of seafood products. However, the implementation of policies/decrees and control programs are not carried out synchronously among industries, provinces and food producers. As a result, the effectiveness of the implementation is at a low level and hazard infection still exists (Loc, 2002).

Regarding decentralized management, again the government is represented by the Ministry of Fisheries, which has issued fishery safety and quality control regulations directly to the local governments, farmers, SFCs, and the offshore fishing community. Besides, the authority and the liability of NAFIQAVED are nowadays enhanced in terms of the issuing, the management, and inspecting of fishery quality control policies and regulations. NAFIQAVED is responsible for implementing quality management throughout the local government, provincial agricultural departments, seafood companies and other relevant institutions and organizations – both in primary production and at other stages of the chain.

The reality is that there is little coordination between these institutions and organizations. Therefore, local governments need to train primary producers and to establish regulatory control programs to ensure food safety and wholesomeness at the primary production level. To do this effectively, provincial extension centres and departments of agriculture and aquaculture are important support channels for training, for the implementation of instructions, and for inspection. A link is needed between the observation and inspection by technicians and extension staff, and the farmer's implementation of quality control measures. This means that the SFCs should join forces with local departments to assist farmers in producing good quality shrimp materials.

4.1.2 The role of seafood companies

In primary production, SFCs can use the tools of supplier quality management and partnerships to achieve quality control and safety objectives. In general, SFCs are not able to use these tools to manage and control product quality and safety at all stages of primary production due to managerial and technological conditions. However, SFCs are able to participate with government institutes and NAFIQAVED in managing and controlling shrimp quality and safety at the level of the collectors and wholesale buyers.

4.1.2.1 Supplier quality management

Supplier quality management includes (1) partnership with suppliers (chain partnership); (2) supplier selection criteria; (3) participation in supplier business; (4) supplier performance evaluation; (5) supplier quality audit; (6) supplier quality improvement projects; and (7) supplier communication. Figure 4.2 shows that SFCs are able to buy their shrimp materials from farms, wholesale buyers and offshore fishing communities – either directly or indirectly. More specifically, farmers sell their shrimp either directly (16.7%) to the SFCs or indirectly through collectors/wholesale buyers (61.8%). In addition, the SFCs in the MD buy shrimp materials from farmers in which these companies have made financial and technical investments (21.5%). Regarding shrimp quality and safety at the collector/wholesale buyer stage (SFC's suppliers), SFCs can make official contracts that specify requirements for shrimp material quality and that introduce attractive policies (support of capital, equipment, training, and price information). The indicators of quality need to be clear to the suppliers (i.e. varieties of shrimp size, grading, colour, even allowing sampling or 100% inspection). In contrast, SFCs need to guarantee stable business for the suppliers in order to convince them to provide good shrimp material on a long-term basis. Moreover, the evaluation of suppliers and their feedback to the SFCs every three to six months is crucial to the supplier improvement process. However, companies are not eager to participate in collector's activities (content ③) because it is time-consuming, and the cost is high.

4.1.2.2 Partnerships

Within the supply chain, every company conducts several specific activities to transform raw materials into final consumer products. This concept has been made more explicit by Porter's (1985) concepts of "value-added chain" and the "value system". Every company is part of a value system, and by cooperation the entire performance of the value system can be improved. For those companies operating in agribusiness and the food industry it is important to establish value-added partnerships (VAP). The basic idea is to cooperate with partners that fit best with the company's own competencies in order to create synergetic effects. VAP partnerships are defined as cooperation among companies to achieve common objectives and to meet customer needs at a maximum of added value and a minimum of costs. The success of a partnership

becomes apparent in aspects such as higher quality products, increased market access, and more efficient processes. In other words, partnerships will only last if they meet the key factors of successful partnerships. If common objectives are divided and coordinating actors lose their influence, the partnership may well deteriorate. SFCs in the MD need to cooperate by establishing common quality criteria and pricing policies when buying shrimp materials from their suppliers. These agreements between SFCs should to prevent the purchase of low quality shrimp materials. The farmers or collector/wholesale buyers ought to be responsible for improving the quality of their products. This ensures both a high price and a high rate of SFC acceptance of their products. Therefore, partnerships between SFCs make a highly necessary contribution to the improvement of shrimp quality and safety in primary production.

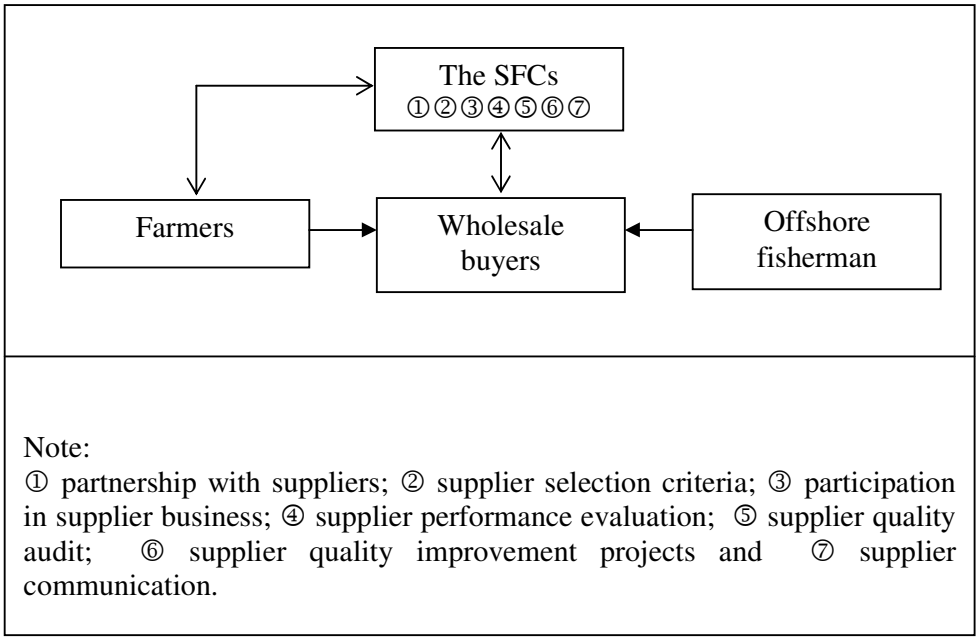


Figure 4.2 Tools for supplier quality management

Another relationship that has to be established for quality and safety assurance of shrimp materials is with local agricultural departments, SFCs, and NAFIQAVED. The common quality criteria set up by SFC partnerships are not only sent to their suppliers, but also to agricultural departments and NAFIQAVED. All organizations involved receive the decrees and regulations regarding fishery quality and safety from the Ministry of Fisheries. On the one hand, they are responsible for distributing these documents to their functional units in primary production. On the other hand, just like the SFCs they need to

cooperate to meet SFC quality objectives and play a role of inspector/auditor in production, maintenance, and transportation of shrimp materials.

4.2 Measures for shrimp quality management and improvement in SFCs

4.2.1 Quality control problems at the company level

According to the survey results (detailed in Figure 3.6), there are five main factors that affect the quality of final shrimp products for SFCs in the MD. These factors are: (1) the lack of test equipment; (2) processing techniques; (3) the limitation of quality control management; (4) the backward technology; and (5) inadequate storage. These problems relate to product quality control management and implementation of the HACCP system for product safety and quality assurance, and they fit in with the more general set of problems mentioned by Luning et al. (2002):

- A low level of education makes it more difficult to involve operators and employees in problem-solving activities.
- The production circumstances such as noise, bad smell, high humidity, et cetera, are often a problem. These conditions can be dissatisfying and demotivating if they are not reduced to an acceptable level.
- As a consequence of the functional organization structure, most knowledge is centralized in specialized departments. This implies that the responsibility for improvement is assessed by specialists that come from those departments. On the other hand, operators have a lot of experience and knowledge, but they are often not involved in improvement activities.
- Equipment is often quite difficult to improve. The knowledge lies with the supplier of the equipment, who also carries out modifications. The user of the equipment often cannot make requests for a particular type of equipment to meet certain needs. He has to choose from the type of equipment that is offered by the (few) suppliers.
- Poor information feedback concerning quality performance results. At the lowest level in the organization, operators are either ill-informed or they are indirectly informed about quality results. This is not very stimulating.
- Improvement activities are usually not rewarded. More specifically, the top management does not show that much appreciation and support.
- Organization methods are not very common in the food sector. In general, the culture is more solution-oriented and proactive, and less time is spent on discussing and analysing.

4.2.2 Quality management in SFCs

According to the revised document of NACMCF (1998), an HACCP system should be built on a solid foundation of prerequisite programs, because these programs provide the basic environment and operating conditions that are necessary to produce safe and hygienic food. Prerequisite programs include

facilities, cleaning and sanitation programs, training, traceability and recall, and pest control. All of these programs must be documented and audited on a regular basis. In fact, 100% of the SFCs in the MD have performed these prerequisite programs (GMP, SSOP) to various extents, depending on each company's conditions for applying HACCP. So far, the SFCs in the MD have not yet successfully implemented the HACCP and prerequisite programs because they lack (i) the financial means to improve and invest in modern technology and equipment, (ii) quality specialists, (iii) managerial knowledge and skills, and (iv) organizational behaviour on quality. Therefore, to maintain safety standards in shrimp production, it is expected that improvements in the HACCP system will be a priority. The successful implementation of an HACCP system is also an important condition if the SFCs want to achieve an ISO standard (higher level for the management of product quality and safety).

Luning et al. (2002) note that the principles of GMP, HACCP and ISO 9000 series are combined in quality assurance (QA) systems. It is expected that this system will be extended to an internationally acknowledged QA system as it ranges from a focus on establishment of procedures to a focus on quality improvement. With respect to the first focus, comprehensive procedures are made for all types of handling in order to control and assure quality. Concerning the second, attention is focused on improvement, and procedures are only implemented where control is essential for realizing quality. In the latter case a more finely tuned system is achieved: one that aims to control and improve critical points with respect to quality. As in each control process, the quality assurance process also consists of three basic steps: measurement, evaluation, and corrective action.

Measurement involves an evaluation of the system, which can be carried out by auditing. An audit is a means by which management can determine whether people in the organization are doing what they should be doing and whether the organization is effective in meeting its goals.

Evaluation includes the comparison with established standards. These standards can be derived from the company's quality policy and/or be provided by external standards such as HACCP, ISO and BRC. Quality assurance is primarily aimed at giving both management and stakeholders guarantees concerning quality and quality systems. Quality assurance therefore has two faces – towards the company it initiates corrective actions, and to external stakeholders it provides confidence and ensures credibility (Van den Berg & Delsing, 1999; J. Andres Vasconcellos, 2003; Inteaz Alli, 2003).

Corrective actions include measures to improve and change the quality system in order to meet quality requirements in the future. Note that external pressure can force change processes when companies feel obliged to meet external standards, such as ISO, within a relatively short period of time. Choosing an

adequate change strategy is very important of one wants to get these processes under control.

Almost all quality control departments of SFCs in the MD are responsible for quality assurance. They gather knowledge of actual standards, organize audits, report evaluation results, organize corrective actions, and communicate with external stakeholders, but only to a limited extent. Quality assurance is the main task of the quality department of each SFC. It is often called the Quality Assurance Department or the Quality Control Department, and it is positioned just below the top management. The Quality Control Department communicates intensively with departments within the organization, which also have other assurance responsibilities such as environmental care, work conditions, and personal welfare of employees. Many companies try to integrate these assurance tasks into one care/assurance system.

4.2.3 Measures to improve the HACCP system

Regarding the quality and safety of SFC products in the MD, one of the main tools of the assurance system is HACCP improvement in terms of technology and management.

4.2.3.1 Technological improvement

In the application of HACCP principles, different interpretations have been noted in practice. Luning et al. (2002) report that some companies have allocated many Critical Control Points (CCPs) to be sure that the safety of their products is ensured. Others are of the opinion that too many CCPs reflect the poor condition of equipment and machines. They feel that technological innovations should be introduced to improve safety and thus reduce the number of CCPs. In addition, many requirements are set by government, industry and customers. The types of requirements that have been set up not only differ, they also change regularly to meet customer needs and expectations.

From the techno-managerial perspective, QA systems should be developed through a profound technical and technological analysis of product process conditions used in assessing CCPs. Within the company consensus must be reached on the selection of CCPs. To this end, the company should do predictive modelling which can be used to identify potential hazards and crucial quality parameters. The Taguchi principles can be applied to determine socially acceptable tolerance. In addition, the application of HACCP principles and risk assessment support the selection of technological CCPs, which have a scientific underpinning. At the same time these principles and risk assessment also provide a scientific basis for the non-critical points. It is important that identification of these critical points is done together with the people that are involved in the processes. The restriction to critical points enables the development of a QA system, which serves as a tool for the people involved instead of being an enforced system. Such a QA system consists of a hard core

based on crucial control points (one principle of HACCP), and modules, which can be easily modified or extended, depending on customer demands. For this approach, a singular focus on procedures is not advisable because it has its limitations in directing human behaviour (Luning et al., 2002).

4.2.3.2 Managerial improvement

From a techno-managerial perspective, Luning et al. (2002) indicate that managerial issues are very important in quality improvement processes. First, one managerial condition for improvement is the use of appropriate measurements and information systems. This information should include the critical quality and safety points that are related to the technological core competences. Furthermore, information must be easily accessible. Statistical tools, such as Pareto analysis, standard deviation, etc., should then be used to analyse the information. Such analysis enables both the people involved and the management to make the right decisions. Second, another essential management activity with respect to improvement is training. The training of operators and employees must be aimed at developing relevant technological and managerial knowledge for the specific quality control points for which they are responsible. Moreover, a training in simple statistical techniques is required in order for people to be able to organize and process data effectively and to use it for analysis and argumentation. Finally, team-building is another important management task, although this cannot be forced and requires good leadership capacities. Managers should not just install teams, but they should facilitate team-building in such a way that teams can grow spontaneously.

A techno-managerial approach would choose management activities that are focused on major points in the process that can be influenced technically. Regarding the implementation of HACCP, the basic idea is that only a restricted number of control points determine the quality that is requested by consumers. In other words, control measures should focus on those points that influence the quality of the final product. An advantage to this approach is that control activities can be reduced, and the attention of employees and operators can be focused only on those points in the process that are relevant for quality (sensory properties, safety, etc.). For instance, the HACCP principles and procedures enable a company to perform a profound analysis of the process and to assess points that are critical with respect to safety and quality. The use of the "tool" should be combined with management actions such as decentralization and training. This combination creates opportunities to control and take corrective actions when required.

4.2.3.3 Organizational behaviour concerning quality

As mentioned in previous sections, technological problems of SFCs that need to be improved are on the one hand investing in new technologies to process high quality products, testing for hazards, and ensuring storage conditions. On the other hand, managerial aspects focus on how to use these technologies

efficiently and effectively. Both aspects require a certain kind of organizational behaviour towards the basis of the "continuous improvement philosophy" (Krajewski & Ritzman, 1999) in order to achieve quality improvement in terms of (1) training and education; (2) management and leadership; (3) motivation; (4) organization; (5) human resources; and (6) information systems.

Training and education of both managers and employees is an important success of the HACCP. Therefore, education and training on the importance of HACCP, the role of people in producing safe foods, and how to control food-borne hazards in all production stages are required (Barendsz, 1994; Codex Alimentarius, 1997; and NACMCF, 1998).

In Vietnam, the Ministry of Fisheries and relevant industries have focused on training and education courses related to quality management. They have organized – free of charge – many training courses on the prerequisite programs, on HACCP principles, and on procedures for SFC leaders. Moreover, the VASEP and the NAFIQAVED, which cooperate with foreign quality control organizations, are responsible for organizing and helping the SFCs train their managers, especially quality controllers, as much time as they need on the HACCP program. However, the SFC employees are not supported in this quality control training by these organizations. The SFCs themselves retrain their employees or pay for them to be trained. According to the survey results, employees have limited understanding and awareness of HACCP and other quality standards. Education and training programs related to quality assurance are extremely important for people who are involved in the activities of the entire chain – from primary producers to distributors in Vietnam and in the MD (Loc, 2002).

A quality improvement process cannot do without management and leadership. Management is a broad concept that encompasses such activities as planning and control, organizing and leading. Leadership, however, focuses almost exclusively on the "people" who have to get a job done. This means inspiring, motivating, directing, and gaining commitment for organizational activities and goals. Leadership accompanies and complements other management functions, but it is more concerned with coping with the dynamic, ever-changing marketplace, rapid technological innovation, increased foreign competition and other fluctuating market forces. In short, management influences the brain, while leadership influences the heart and the spirit (Gatewood, 1995).

Activities of management and leadership are difficult to distinguish in an SFC organization. Top managers decide on all issues – not only on the ones that are related to management but also on those related to leadership. They structure what has to be planned and who implements and controls what within the

organization. Top managers also play a role in market observation of the competition in order to implement changes to meet customer needs. For instance, how to buy high quality shrimp materials in order to produce safe shrimp products to meet market requirements and expectations requires specific activities of the management and leadership; however, top managers cannot do this by themselves or simply force their workforce to do so without providing an explanation.

Motivation is the inner state that causes an individual to behave in a way that ensures that a certain goal is accomplished. In other words, motivation explains why people act like they do. The better the manager understands the behaviour of the members of the organization, the more able he/she will be to influence members' behaviour and to make it more consistent with accomplishing organizational objectives. Since performance is the result of the behaviour of the organization's members, motivating them is a key to reaching organizational goals in general. This means that members of the organization should be loyal and act responsibly, in particular towards the company's quality assurance objectives.
Motivation is necessary for SFCs in the MD. At all levels, SFC managers have to be loyal and responsible for organizational quality objectives. They have to believe in what they do in order to gain organizational success. Moreover, their employees should be motivated as well and encouraged during the processing time because organizational quality responsibility, as conceived by workers, is very restricted. The SFC workforce frequently changes, mostly per season. Therefore, SFCs are faced with difficulties if they do not motivate their employees.

Organization is the process of positioning people and other resources in such a way that they can work together in order to accomplish a goal. Organizing involves creating a division of labour for tasks to be performed and then coordinating the results to achieve the common purpose (Schermerhorn, 1999). An organization is a collection of people that work together to achieve a common purpose. People take action once they have decided on their objectives and they have certain ways to accomplish these objectives. Organizing involves creating conditions for these decision-making processes in terms of:

- People: this includes attracting, developing and maintaining a quality workforce;
- Information systems: these involve ensuring that information gets at the right time and in the right place, and providing resources for collecting, organizing and distributing data to support the decision-making process;
- Organizational structure: this includes defining tasks, responsibilities and authorities, rules and procedures.

Organizational structure is a formal system of relationships that both separates and integrates tasks. A separation of duties makes it clear who should do what. Integration of duties tells people how they should work together. Members of functional departments share technical expertise, interests and responsibilities. Major advantages of a functional structure include the efficient use of functional resources and a high-quality technical problem-solving capacity. On the other hand, a functional structure can be characterized by a lack of communication and coordination between different functions and the loss of the complete picture.

The SFC organizational structure in Vietnam is a functional structure. Members of each functional department work together very well. Still, people in different functional departments do not communicate and coordinate easily when trying to achieve common goals. For instance, in order to achieve product quality by applying HACCP, the company needs an HACCP team that should include members from different functional departments**.** However**,** according to the survey most of the HACCP team members are from the Quality Control Department.

To conclude, SFCs in the MD follow a top-down management system (Loc, 2002). They do not get any feedback from the system to improve the organization. Bottom-up changes are required to achieve this. Bottom-up change means that initiatives for changes come from persons throughout the entire organization, supported by the efforts of the middle and lower management. Bottom-up change is essential for organizational innovation and is very useful in terms of adapting operations and technologies in order to change the requirements of work. Empowerment, involvement and participation enable this bottom-up change. In addition, quality improvement requires facilitating structures, such as the means of communication, procedures and reward systems, the identification of changes in the internal and external business environment and avoidance of routine and rigid structures in the company (Dean & Evans, 1994).

Human resources in quality management are very important: for instance, the way in which the company enables employees to develop and utilize their full potential to achieve the company's objectives. In human resource management a lot of attention is paid to work systems, education, training and development, and the well-being and satisfaction of the employees.

The research by Gerats (1990) provides an insight into the role of the various quality behaviour factors (disposition and ability to ensure quality). The research results of Gerats indicate that to improve hygienic working behaviour, the first sphere of action should be enlarged. It shows that 60% of the workers did not comply with the conditions concerning disposition and ability. It was also concluded that the activity area (ability) for hygienic working behaviour was mainly restricted by shortcomings in management, by low hygiene standards

among workers, by low hygiene standards of first-line supervisors, and by shortcomings in hygiene facilities at the workplace. A disposition towards working hygienically was mainly caused by the limited knowledge of bacteriological contamination mechanisms, by restricted social support from colleagues, by the fact that the supervisors' were hardly interested in working hygienically, and by the restricted possibilities to work hygienically. Furthermore, Ivancevich (1994) added a third factor, namely quality focus. In his view, commitment to quality includes three ingredients:

- Quality intelligence: employees must be aware of acceptable quality standards and of how these standards can be met;
- Quality skills: employees must have the skills and ability to achieve quality standards set by the management; and
- Quality focus: from top management to operating employees, everyone must sincerely believe that quality of all outputs is the accepted practice.

In fact, the findings of our survey related to quality behaviour at SFCs in the MD are similar to Gerats' research. Hygienic working behaviour has not been sufficiently taken care of. For instance, the SFCs have not paid sufficient attention to factors such as personal quality standards, quality of knowledge, observed standards of knowledge, observed standards of leaders, observed opportunities or skills and competence, availability of time, support from colleagues, support by the supervisor, and support from the company. Therefore, factors regarding human resources are conditions for quality behaviour.

Information is a critical enabler for quality management. More and more successful companies agree that information technology and information systems are keys to their (quality) success. Three categories of information are mentioned as being crucial to quality management: (1) *operational information* with an emphasis on process management, action plans and performance improvement; (2) *comparative information* related to comparative position and best practices, both having an operational and strategic value; and (3) *information* that relates process management to business performance by providing an insight into cause/effect relationships (Ross, 1999). Information technology has many effects, including the improvement of performance and the affection of organizational structure. It helps firms to retrieve information faster and more conveniently, and this enhances decision-making.

Information technology and systems for management in general and quality management in particular are limited in SFCs in the MD. On the one hand, these SFCs manage files in the form of paper documents rather than by computer. On the other hand, limited knowledge of computers and statistics leads to little effectiveness of inputting, saving and analysing data for process management, business performance as well as performance improvement.

4.2.4 Shrimp quality and safety at SFC distribution

Distribution control involves the management of materials flow from the manufacturer directly to the customers/consumers and from the warehouses to the retailers. It also includes storage and transportation of products. Quality control in distribution management concerns decisions on transportation, storage of products, and measuring the whole process, including consumer usage of the products. The steps in distribution control include product and resource decisions, such as selling and receiving orders, transportation and storage, buying and consumer usage, complaints and market information, and analysis. However, based on the practical situation of the SFCs in the MD, shrimp quality and safety improvement in the distribution stage focus only on transportation and storage (details in Figure 3.7). Most of the SFCs in the MD sell their products by FOB (Free On Board). This means that most of the SFCs in the MD contract deliver their products to the Saigon harbour in Ho Chi Minh City, which is a long distance from the MD. Other activities at the harbour are out of the SFCs' control. Therefore, transportation and the time to maintain quality assurance conditions for the products from the company to the harbour are very important. Moreover, the SFCs do not have sufficient means, so they have to hire transportation. They cannot always be sure of the quality of the means of transport, because the transport is not managed by the SFCs. With respect to storage, almost none of the SFCs have enough warehouses to store products, especially during the shrimp season. The same as with transport, the SFCs have to rent warehouses – not only to store shrimp materials in the region, but also for the final products in the harbour in order to meet contract requirements. These warehouses are controlled by individuals or other companies in Ho Chi Minh City or other places. To summarize, SFCs cannot manage and do not control storage conditions to meet quality assurance objectives. According to the interviewees, the factors that affect product quality in the distribution process are the means of transport (34.4%), the transportation time (21.9%), storage conditions (31.3%), and inventory time (53.1%).

In food distribution, transportation and storage can be a complex process, part of a long supply chain. Product control during transportation and storage involves the quality of the products by monitoring the product and taking corrective actions when necessary. Resource control involves transportation of equipment, distributor organization, and storage conditions. In the food industry, temperature and humidity together with hygiene are very important control parameters. To achieve this, partnerships between SFCs and individuals or companies are necessary to ensure quality during transportation and storage.

4.3 Summary

Chapter 4 demonstrates the basis for developing a seafood supply chain quality management framework. By using the techno-managerial approach, the framework aims to ensure and improve seafood in general, and shrimp quality and safety in particular in the MD. It consists of measures for seafood quality control management in primary production, in the company, and at the distribution stage. At the company level, quality assurance by means of the HACCP tool is discussed. The measures to improve the HACCP system in terms of management, technology and organizational behaviour are described in detail. These issues will also be taken up in two case studies in the next chapter, i.e. Chapter 5.

The framework also includes the role of the government through local fishery departments (Department of Fisheries, and the Extension Centre, FRDP) and the role of industry in establishing quality assurance in primary production but also in the entire chain. In addition, the supporting roles of VASEP and NAFIQAVED in seafood hygiene and safety, quality knowledge training, hazard inspection of final products before export are also discussed in the framework's explanation. In the chapter on improvement (Chapter 6), these roles will be discussed in more detail.

Chapter 5

Test of The Quality Management System In The MD's Seafood Companies

As introduced in previous chapter, the diagnosis phase deals with quality control management in SFC, of which HACCP focused. This part of the framework should therefore be applied in SFCs for the feasibility of its implementation in actual practice. To do this, first of all two case studies were chosen. The theoretical bases for choosing each case study are set out in Part 1.5.5 (Chapter 1). And, in order to generalize from the conclusions, case selection is an important step. Cases must be selected by using replication logic, either to predict similar results or to produce contradicting results (Tsikriktsis, Voss and Frohlich, 2002; Meredith, 1998; Yin, 1994). After choosing the case studies, a test plan is designed (Appendix 7). Consequently, the quality management in general and HACCP system implementation in particular are tested in two chosen SFCs in the MD. Finally, test results and discussion in relation to quality management issues in SFCs and their chain elements are presented in this chapter.

5.1 Selection of case studies and test plan

5.1.1 Case selection

Based on case literature and features of SFCs in the MD, two seafood companies were selected for testing the framework. Choosing companies with different indicators is necessary. If SFCs with different features have similar test results for framework development, the framework can be applied to other SFCs in the MD. Thus, any test of the framework has as its expectation the same results for a generated purpose from one sample to the population as a whole. One SOE is choosen from 65.6% of SOEs and the other one is a Stock SFC. The private companies didnot allow to test the framework. The main features of the two test companies are described in the following table.

Table 5.1 Main characteristics of selected cases in terms of the indicators

Variables	Ownership (1)	Employee (2)	Location (3)	Experience (4)	% of Managers (5)	Technology Investment (6)	Quality system (7)
Company A	State-owned	773	Bentre, far from SRM*	23 years	11%	90% with old TI	HACCP ISO
Company B	Joint Stock	1100	Camau, Inside SRM	9 years	3%	90% with modern TI	HACCP ISO BRC SQF

Source: The companies' reports
(*) SRM: Source of raw materials

Companies A and B are differentiated by ownership, location, number of employees, company location, business experience, managerial structure, technological characteristics, and quality control system.

5.1.2 Test plan

In order to implement a test of the quality control management framework, a test plan has been designed. Appendix 7 demonstrates the test plan and test contents regarding the HACCP test indicators.

Step 1: Contacting the test companies

After two specific SFCs were chosen, the companies were contacted to confirm the test activities and to seek formal permission to proceed. At this point, the test plan, the test contents and the activities had necessarily to be discussed with the management of the two test companies. Top managers made the final decision for the test implementation.

Step 2: Collecting data and information

The test started with the collection of common data and information from the test companies and their chains. The data and information included indicators of establishment date, business scope, product, market, quality policy, supplier, shrimp quality control system, technology, management, and other chain stakeholders. The methods for collecting primary information were interviews, questionnaires, and observations. Secondary data relating to shrimp quality management were collected from company documents and reports, as well as from local departments' materials. Appendix 7 shows test information, empty tables with given contents that needed to be filled in, as well as a detailed description on how to fill in the empty tables. Tables 5.2 & 5.3 show the step results.

Step 3: Applying a test of HACCP principles and procedures

Many questions were asked about the contents of a test for HACCP implementation at the two companies. The questions focused on issues relating to prerequisite programs (GMP and SSOP), the assembling of the HACCP team, the product itself and its distribution, the identification of intended use and consumers, the development of process flow diagrams, the on-site verification of the flow diagram, the conducting of hazard analysis in the company (Principle 1), the determination of Critical Control Points (Principle 2), the establishment of critical limits for each CCP (Principle 3), the establishment of a monitoring system for each CCP (Principle 4), the establishment of a corrective action plan (Principle 5), the verification of the HACCP plan (Principle 6), and, finally, the establishment of record keeping and documentation (Principle 7) (see Part B2 Appendix 7 for details). The results of this step are presented in Table 5.4.

Step 4: Suggesting a quality control improvement process

The implementation of Step 4 is based upon comparing the test results with the companies' quality control objectives in general and the HACCP norms in particular. Results of the comparison indicated quality gaps and chain deficiencies. From this comparison, the companies should be able to make a quality improvement plan and create a procedure to implement it. From this research, a quality improvement procedure will be suggested and presented in the next chapter.

The next section will deal with the companies' general information and test results. An explanation and discussion of the companies' general information and test results will be presented in Sections 5.2 & 5.3.

5.2 Company information and test results

5.2.1 General information relating to the two test companies

General information relating to the two test companies is represented by indicators that are shown in the following table.

Table 5.2 General information relating to the test companies

Company A	**Company B**
Company's general characteristics	
- *Date of establishment:* 24/01/1978 - *Located in:* Bentre province - *Business scope:* Culturing, processing and exporting fisheries products - *Quality certificates:* HACCP, EU Code No. DL 22, ISO 9001:2000 - *Main export market:* EU, Japan, USA - *Production technology:* Block, Air-blast and Straight belt IQF Freezing - *Labour force:* 773 full time employees - *Freezing capacity:* 5,000 MT/year - *Distribution:* Importers, wholesalers, retailers, industrial/processing enterprises. - *Company's quality policy:* **"**Improving production process and managerial system continuously, satisfying customers' requirements at the highest level and becoming a credible (believable) seafood supplier for domestic and foreign partners". - *Main facilities:* IQF processing line, Complete shrimp cooking line, Air-blast freezer, Contact freezers, Flake ice machine and Laboratory. - *Main products:* Frozen black tiger and fresh water shrimp, Scampi, Clam and Tra/Basa fish. (Figure 5.1) - *Company's advantages:* • Near to source of raw materials • Managerial experience of management and staff • Leading exporter of clam and fresh water prawn (big shrimp) • Quality management system of the company meets international standards. • Stable export and domestic markets • Successful use of price policy in input material competition	- *Date of establishment:* 01/11/1995 - *Located in:* Camau province - *Business scope:* Processing fisheries products for overseas and domestic markets - *Quality Certificates:* HACCP, EU code No. DL130, ISO 9001:2000, SQF 2000^{CM}, BRC, and Vietnam Quality Award 2002. - *Export market:* USA, Japan, Canada, Korea, Hong Kong, China, EU and other countries. - *Labour force:* 1,100 full time employees - *Distribution:* Importers, industrial/processing enterprises. - *Company's policy:* **"**The quality management system is continually improved to meet higher and higher customer needs". - Products:(Figure 5.2) • Frozen headless shell-on black tiger shrimp (HLSO) • IQF raw peeled and deveined tail-on black tiger shrimp (IQF RPTO) • IQF cooked peeled and deveined tail-on black tiger shrimp (IQF CPTO) • Breaded nobashi black tiger shrimp (EBI FURAI). • Frozen head-on shell-on black tiger shrimp (HOSO) • NOBASHI peeled and deveined tail-on black tiger shrimp (NOBASHI PTO) • IQF raw peeled and deveined tail-off black tiger shrimp (IQF RPD) - *Company's advantages:* • Quality management system of the company meets international standards • Company is located in the area abundant in wholesome shrimp materials including organic shrimp (buying shrimp from offshore directly) • Hygienic and modern facilities have been installed • Company's infrastructure for processing is good • Workmanship of workers is perfect • Company is ready to cooperate with external and internal partners in processing and trading seafood

- *Company's disadvantages:* • Unstable local material source • Great competition in buying raw materials • Weak and limited in market research • High requirements for seafood product quality in the EU market • Lack of capital for investing in modern technology	• Company is ready to manage processing according to customers' procedures - *Company's disadvantages:* • Great competition in buying shrimp materials • Passive in preparing shrimp materials when out of shrimp season • Limited shrimp material quality management because of a lack of technicians for instructing farmers in breeding techniques • Unsure transportation conditions due to large distance from ports • High costs for transportation • Limited inspection conditions for shrimp contaminants • Constant change in customer behavior
Managerial structure	
- Managerial staff: *11%* - *Level of education:* • University level: 46% • Intermediate level: 54% - *Quality management training:* • For managers: 100% • For employees: 100%	**- Managerial staff: 3%** - *Level of education:* • University level: 57% • Intermediate level: 43% - *Quality management training:* • For managers: 100% • For employees: 100%

HOSO FRESH WATER PRAWN

COOKED PDTO BLACK TIGER

Figure 5.1 Some examples of shrimp products from Company A

Figure 5.2 Some examples of shrimp products from Company B

The table information shows not only the basic characteristics of the two test companies, but also the differences between them. Characteristics such as ownership, number of employees, geography, experience, scale, quality control policy, managerial structure and education, invested level of technology and capital, advantages and difficulties in their business operation are listed. Generally, Company B's status quo is better than that of Company A in terms of the percentage of managerial staff, the level of managerial education, as well as the investment in technological processes.

5.2.2 Quality management information of the two test companies

The contents in this section comprise (i) the companies' supplier quality control management, (ii) quality control systems, (iii) level of technological investment (TI) related to quality improvement and assurance, (iv) and support organizations (see Part B1, Appendix 7 for details). The following table shows the results.

Table 5.3 Chain information for the companies

Company A	**Company B**
(i) Supplier Quality Management	
Criteria to choose suppliers: - Quality, safe and hygienic conditions - Capacity and potential of supply	- Criteria contract: quality, supply stations, transportation means, supply time, and capacity, as well as potential of supply
Participating with the suppliers - Inspection of the supplier's conditions quarterly	- Visiting suppliers

Evaluating the performance of the suppliers - Nothing	- Every first quarter per criteria of the Contract
Auditing supplier quality - Direct audit on shrimp materials	- Visiting, inspecting supplier's conditions and testing shrimp materials if necessary
Improving supplier quality - Nothing	- Providing quality control documents, meeting and combining with local departments to train for quality control aspects
Communicating with the suppliers - By telephone or in person	- By telephone, fax and in person
(ii) Quality systems	
Quality systems - HACCP and ISO	- HACCP, ISO, BRC and SQF
Level of implementation of each system (%) - HACCP (80%) - ISO (80%)	- 80-90%
Limitations to these quality systems - HACCP: cannot follow HACCP procedure during shrimp seasonal time - ISO: capital and technological conditions	- HACCP: cannot follow HACCP procedure due to frequent new employee turnover - ISO: capital and technological conditions
(iii) Level of technological investment (TI) related to quality improvement and assurance	
Kinds of equipment and technology invested in - Enough technology for present processing and storage	- Enough technology for present processing and storage
Current need for TI (% of the need): 90%	**Current need for TI (% of the need): 90%**
Technological and equipment problems - Lack of equipment for quantitative testing for hazards - Outdated technology and equipment	- Lack of equipment for quantitative testing for 10 banned antibiotics

(iv) Support organizations for both Companies A and B
VASEP - Providing market information - Training on quality control knowledge - Negotiating internationally - Organizing national SFC meeting - Providing export documents quickly
NAFIQAVED - Inspecting hazards in Saigon branch (for Company A) and in Camau (for Company B) - Controlling for a given period in the company - Issuing quality and safety regulations - Training in quality control knowledge
Extension Centre (in primary production) - Training in culture techniques - Inspecting culture procedures - Expanding regulations for quality and safety assurance - Controlling implementation progress

5.2.3 HACCP test results

Table 5.4 HACCP test results

HACCP implementation in the companies	
Prerequisite programs (GMP and SSOP) - Yes but not completely (80%) Reason: shrimp high season	- Yes but not completely (80%- 90%) Reason: frequent turnover of employees
HACCP implementation 1. HACCP team: 7 people 2. Describing the products and its distribution: perfect 3. Identification of intended use and consumers: - Market segments: foreign distributors and companies - Potential risks: Uncontrollable antibiotics and micro-organisms.	**HACCP implementation** 1. HACCP team: 8 people 2. Describing the products and its distribution: perfect 3. Identification of intended use and consumers: - Market segments: foreign distributors and companies - Potential risks: micro-organisms

4. Development of process flow diagrams: - Most of the contents implemented and controlled, but neither frequently nor completely 5. On-site verification of flow diagram: - Operation process inspected, but not frequently 6. Conducting of a hazard analysis in the company (Principle 1): - 30% of the contents implemented 7. Determination of Critical Control Point (CCPs) (Principle 2): - Three CCPs: input shrimp materials, boiled stage and metal test - 100% of the contents implemented at three CCPs 8. Establishment of critical limits for each CCP (Principle 3): - Preventive measures for each CCP - Critical limits based on industrial and customer criteria 9. Establishment of a monitoring system for each CCP (Principle 4): - Nothing except visual inspection for physical and chemical hazards 10. Establishment of a corrective action plan (Principle 5): - 100% of the contents implemented 11. Verification of the HACCP plan (Principle 6): - 60% of the contents implemented by the company - Once a month by NAFIQAVED 12. Establishment of record keeping and documentation (Principle 7): - 100% of the contents implemented but not updated on time	4. Development of process flow diagrams: - Most of the contents implemented and controlled, but neither frequently nor completely 5. On-site verification of flow diagram: - Operation process always inspected 6. Conducting of a hazard analysis in the company (Principle 1): - 70% of the contents implemented 7. Determination of Critical Control Point (CCPs) (Principle 2): - Three CCPs: input shrimp materials, boiled stage and packaging - 100% of the contents implemented at three CCPs 8. Establishment of critical limits for each CCP (Principle 3): - Preventive measures for each CCP - Critical limits based on guidance documents, legal documents, experiments, and industrial and importer criteria 9. Establishment of a monitoring system for each CCP (Principle 4): - 80% of the contents implemented 10. Establishment of a corrective action plan (Principle 5): - 100% of the contents implemented 11. Verification of the HACCP plan (Principle 6): - 100% of the contents implemented by the company 12. Establishment of record keeping and documentation (Principle 7): - 100% of the contents implemented
Storage and transportation conditions	
Storage conditions - Inside the company: good - Rented warehouses: uncontrolled	*Storage conditions* - Inside the company: excellent - Rented warehouses: uncontrolled

Transportation conditions	*Transportation conditions*
- Of the company: quality indicators ensured (100%) - Rented transportation: uncontrolled	- Of the company: quality indicators ensured (70%) - Rented transportation: uncontrolled

5.3 Explanation and discussion of test results

Generally, Company B differs from Company A in terms of supplier management and quality systems. Company B has implemented good policies for its suppliers in order to maintain and improve product quality such as providing capital in advance and means of storage. It also uses different means of communication to contact and inspect the supplier's product quality. In addition, Company B has applied ISO, BRC, and SQF, along with HACCP. Basic differences are listed in Table 5.1. The ownership of the two companies is the most important factor determining the differences between the two. Because Company B is a joint stock company, it actively implements changes in quality improvement, capital investment, quality control behavior, quality control management, and technological investment. Further explanation and discussion regarding the information in the tables is found under the topics "quality gaps in the companies" and "chain deficiencies."

5.3.1 Quality gaps in the companies

5.3.1.1 Technological gaps

There are two kinds of technologies invested in SFC. They are processing technology and test technology. Regarding processing technology, the two test companies have enough equipment and technology for processing and storage. Although the level of technological investment presently accounts for 90% of the quality control needs (Table 5.3, ii & iii), the effective use and status quo of the technology are still in question. In fact, the companies have mainly invested in technology and equipment for their processing procedure, such as investment in GMP, SSOP, and HACCP implementation. This investment accounts for more than 90% of the total technological investment capital. However, most of the given technologies and equipment are obsolete and more than 10 years old and use to produce "raw products" like frozen shrimps (Table 5.1, 4). And, during the shrimp seasons old technology cannot produce to its capacity. In contrast, during the none-shrimp seasons the technology faces very long idle time and then works again that causes physical hazards and low product quality. When many products are produced at the same time, economies of scope are

applied by using the same equipment to produce more than one product. As a result, the quality control problems involved in cross-contamination between products has not been completely resolved. Furthermore, customer' requirements are today changing so fast in terms of product diversification (value-added products instead of raw products), safety and quality, so almost all SFCs in Vietnam in general and test companies in particular today lack modern processing technology to respond to these expectations. For example, many customers from the US and the EU want to buy "fresh shrimp" products but none-SFC can provide this kind of products because the products need very modern technology to produce. These difficulties have also warned by the world's shrimp experts in Global Shrimp Outlook held in Viet Nam (Oct., 2005) that "one of three biggest challenges of Vietnam's shrimp industry in the near future global competition is lack of modern technology in both culture and processing".

Similarly to processing technology, test technology is very important to ensure product safety and quality within the company as well as within the chain. On the one hand, the companies lack technology and equipment to test raw materials in its chain actors, in each CCP, and in finished products. At company level, important CCPs, such as CCP at input material, CCP at frozen place, CCP at storage and CCP before exporting, really need product tests but they are not tested sufficiently. On the other hand, the companies have very limited capacity to invest in modern "quality control testing" technologies. In recent years, while main import markets such as the US, the EU and Japan have continuously changed criteria of their technical barriers with the lowest level, Vietnam SFCs have faced these difficulties due to modern test technology shortage.

5.3.1.2 Managerial gaps

Test results of Companies A and B indicate that the percentage of managerial staff ranges from 3-11%. Of this percentage, around 50% have received a university education and all of them were trained in quality control management and quality assurance. Each company has a quality control department. Their staffs are responsible for quality control, quality improvement and quality assurance of the company products. According to the interviews, the staffs in the quality control departments have senior managerial responsibilities but they lack the statistical management knowledge to apply and analyse the results of CCPs and critical limits for management of CCPs. The quality control department of each company has established four managerial groups to observe the stages of the processing procedure. Nevertheless, the heads of the quality control departments said that the companies' employees still had a limited understanding of quality assurance and the implementation of quality assurance within production. On the one hand, during the high shrimp season the departments lost control of some stages in the procedure. For instance, the inspection of shrimp materials was ignored; data reports were not on time;

worker observations were ignored. On the other hand, the companies were not able to implement a thorough procedure management because factors such as the time needed for implementation and the cost of implementation adversely affected the final product cost. Moreover, while approximately 80% of the contents of GMP, SSOP, HACCP, and ISO procedures were controlled and managed inside the companies, they could not control and manage the product quality of their suppliers due to their limited managerial capacity.

Furthermore, overall the employees of the two companies within the test have received a basic training in quality assurance. However, because of a low level of education and a lack of self-discipline, they have a limited awareness of the importance of quality assurance. They think that the responsibility for quality assurance belongs to someone else within the company. Therefore, employee management during production time is very important in order to achieve the quality objectives. Additionally, each company has a seasonal workforce. This workforce is changed from time to time and this makes it difficult for both the company and the employee to gain, to maintain and to enhance the level of quality assurance knowledge.

5.3.1.3 Quality system gaps

Both Companies A and B have applied the HACCP and ISO systems to improve and to assure product quality and safety, yet the implementation level is still around 80% due to loss of control in some stages of the procedure. This loss of control is particularly evident with the approach of the coming shrimp season and the frequent turnover of new employees and their training. Although Company B has more quality systems in terms of SQF and BRC, these systems also lose control for the same reasons. Thus, the effectiveness and efficiency of these quality assurance systems are still low. Regarding HACCP implementation, although most of the HACCP principles and procedures have been introduced within the companies, the execution of these principles is infrequent and incomplete. The HACCP principles and the test of the procedure will be explained and discussed as follows:

- ***Development and on-site verification of flow diagram***

At the process flow diagrams development stage (Appendix 7, B2, Part 2.4), the companies have implemented most of the contents of *on-site verification* except for technical data that is obtained from product loops. They exist for the recycling or reworking of products and other features of equipment design. Where analysis and verification were impossible because not all of the stages were controlled, the HACCP team did not ensure that the flow diagram contained the most likely processing options.

- ***Conducting a hazard analysis in the company (Principle 1)***

As for conducting hazard identification, the HACCP team has not reviewed all potential hazards related to facility design, e.g., adequate separation of raw and processed materials guaranteed; survival during processing steps, e.g., heat-resistant toxins; packaging, e.g., packaging damage resistance, tamper-evident packaging; condition of the shrimp which favors microbial growth, e.g., composition, pH, $a_{w;}$ and deviations in managing the process, e.g., processing delays, technical trouble.

In hazard analysis, the HACCP team lacked evaluation for potential hazards relative to the severity of a potential hazard, e.g., magnitude and duration of illness or injury; likely occurrence of hazard, which is usually based on a combination of experience, epidemiological data, and information in the technical literature; qualitative and/or quantitative evaluation of the presence of hazards; the number of people potentially exposed to the hazard; age/vulnerability of those exposed; survival or multiplication of micro-organisms of concern; production or persistence in foods of toxins, chemical or physical agents; and conditions leading to the above.

- ***Determination of Critical Control Point (CCPs) (Principle 2)***

Both test companies have established key CCPs in the processing procedure, but they lack methods to control them. For example, there is no method for observing hazards where contamination occurs at unacceptable levels or where contamination increases to unacceptable levels. Similarly, there is no method available to either eliminate or to reduce the hazards to an acceptable level. These limitations are caused by statistical constraints at all levels of management.

- ***Establishment of critical limits for each CCP (Principle 3)***

In order to ensure prevention, elimination or reduction of hazards to an acceptable level, the critical limits could be based on guidance documents, legal documents, experiment, and industrial and importer criteria. Because each CCP has one or more preventive measures, quality control staff has said that there are no gaps in the implementation of Principle 3. However, the critical limits are established in theory only and they have not been implemented in practice due to statistical limitation.

- ***Establishment of a monitoring system for each CCP (Principle 4)***

Company A has implemented Principle 4 at a low level either because the monitoring was interrupted or because the monitoring was no more than a visual inspection for physical and chemical hazards. Whereas Company B has implemented most of the elements of CCP monitoring, it has not conducted that part which could provide information about how to adjust the process before a deviation occurs. This means that Company B lacks the potential to solve problems if some uncontrolled activity in the procedure fails.

- ***Establishment of a corrective action plan (Principle 5)***

According to the quality control staff, there are no gaps in the implementation of this principle. Generally, the team ensures that the CCP has been brought under control, correction and a record made. Generally speaking, a corrective action plan should provide information about which actions might have been taken when the critical limits were exceeded. It should also indicate who was responsible for implementing and recording the corrective action. However, corrective action is often late because employees are passive in their behavior. They seldom provide feedback about the quality of the products.

- ***Verification of the HACCP plan (Principle 6)***

In order to determine the validity of the HACCP implementation, verification of the HACCP plan is necessary to ensure that the system is working according to plan. Establishing procedures for verification that the HACCP is working correctly depends on the conditions in each company. As with other SFCs in the MD, the two test companies have applied HACCP. They have implemented HACCP program verification from prevention through to finished product testing, including record keeping and written reports. However, an important limitation for both companies is that verification is infrequent and interrupted.

Test contents of Principle 6 are listed in Appendix 7, B2, 2.11. The gaps in this section are due to the fact that the companies did not include some content related to the validation of processing steps by means of sampling and testing CCPs; the application of processes for delivery conditions required certain conditions (time and temperature conditions); microbial analysis conducted to validate food safety, or storage experiments should have been applied to confirm the product's shelf life; and a check on the training level and knowledge of personnel responsible for monitoring CCPs in verification content should have been conducted. In fact, these issues have been of concern to the companies, but at a low priority level because of their own conditions.

- ***Establishment of record keeping and documentation (Principle 7)***

The HACCP team performs the documentation and record keeping for the HACCP system for the companies. The team documents process flow diagrams; it conducts hazard and CCP analysis; it records information about ingredients, processing data, specifications of packaging materials, product temperature during storage and distribution, deviation, corrective action, and employee training. However, documents and records are not updated on time for various reasons, such as peak periods during shrimp seasons. Therefore, record keeping and documentation are often used by higher authorities for the purpose of checking and auditing, not for quality improvement and assurance objectives.

5.3.1.4 Gaps in storage and transportation

According to the test results for storage and transportation, both Company A and Company B have the same problems in renting warehouses and transportation. In this case, the conditions for hygiene, temperature and maintenance of equipment are not guaranteed during storage and transportation, especially when the company's locations are far from the harbor: Company B is one example. Although storage and transportation conditions are managed and controlled internally, the companies have different levels of quality assurance (100% of Company A and 70% of Company B). Company B needs to rent storage for longer periods and to transport further than Company A.

5.3.2 Deficiencies in test company chains

The quality and safety of final shrimp products is affected not only by the gaps in quality during the implementation of quality management programs and the implementation of HACCP procedures and principles, but also by the quality of safety measures used in the supply chain by stakeholders that include support organizations such as the VASEP and the NAFIQAVED. Therefore, these deficiencies, or gaps in quality, are then described in order to create a complete picture of the measures necessary to improve and assure the quality of the company's product. The identified deficiencies are based on official interviews with sample/leader representatives of the chain stakeholders, research overviews and the company's quality control staff. The chain deficiencies identified in this study include hatchery, farm, feed wholesaler, wholesale buyer, and support organizations and institutions. According to the survey results for 32 SFCs in the MD and the interview results for the two test companies, chain deficiencies show little difference from company to company. The following are the main deficiencies of the chain that need to be corrected in order to achieve quality control and safety assurance objectives.

5.3.2.1 Deficiencies in hatchery production

The first element affecting a finished shrimp product is the quality of the shrimp seed. So far, the two test companies have not contributed directly to any activity at the hatchery stage. While SFC participation is still negligible at this stage, SFCs need to consider how the following deficiencies can contribute to their role in shrimp seed improvement.

The main deficiency in the hatchery stage is the quality of shrimp seed from internal and imported sources. So far, the test SFCs do not have a procedure to ensure the quality of the shrimp seed. The hatcheries need the companies to invest in equipment for their activities, such as capital and test equipment for controlling the quality of the shrimp nurseries, discovering diseases and examining for other defects before selling them to farmers. While SFCs do not have sufficient capacity to take on this responsibility, direct support from the extension centre in controlling the quality and safety is crucial. In addition, the

relevant fishery organisations, such as the Department of Agriculture and FADP, perform state management in a general way and are not concerned with knowledge of quality control and the responsibilities of the hatcheries. These issues have had an extreme effect on the quality of shrimp seed.

5.3.2.2 Deficiencies in production by the shrimp farmer

Both Companies A and B have bought shrimp material from three sources: directly from free farmers who culture shrimp by means of their own capital, from invested farmers who are invested in by means of capital from SFCs, and from wholesale buyers. The farmers realise that four elements contribute to the quality control of the shrimp culture procedure: water treatment (culture environment), shrimp seed, shrimp feed, and culture techniques. They also emphasized that all four elements are crucial. For instance, the water source is currently heavily polluted by human and agricultural waste such as fertilizers, pesticides and other growth stimulation medicines. Although water treatment is a very important step in the culture preparation stage, the farmers cannot prevent all of the pollution during culture time. Under these circumstances, the farmers need help from the technicians of an extension centre. So far, Companies A and B have only used their money to contract for technical staff at high cost in order to control the quality of shrimp material from the companies' invested farmers. At present, the farmers strictly implement the stipulations on the use of antibiotics and other chemical substances from extension programs, extension staff, newspapers, television, bulletins, and loudspeakers. However, nobody can control the farmer's use of medicine when shrimp diseases occur.

In addition, the farmers really do not know the origin of the shrimp seed. Therefore, before buying a large quantity, the farmers must test shrimp seed at either universities, fishery departments or at the NAFIQAVED. This is expensive and the farmers have to pay approximately VND 400,000/100 tested shrimps. If the quality of shrimp seed is not good then the farmers must continue to test until they find good quality shrimp seed. The farmers agree that many diseases currently infect sources of shrimp seed. Thus the cost of testing sometimes increases to VND 5-7 million. Nowadays, SFCs cooperate with feed processing companies. Feed companies have suitable policies to help the farmers. For instance, they have introduced high quality shrimp feed and guided culture techniques to the farmers directly by means of their technicians or indirectly by telephone. Moreover, feed companies play a wholesale buyer role for SFCs. In this particular case, the farmers can receive shrimp feed in advance from feed companies provided they sell shrimp material back to the feed companies. In spite of supporting the farmers by this way or in various other ways, neither SFCs nor the farmers know the shrimp feed processing procedure, feed ingredients, and substances that can infect shrimp during feed production time. The reasons are (i) feed companies are located far from SFCs and the farmers, some even abroad, and (ii) only wholesalers of feed companies do the

implementation, not feed companies directly. So far, the two test companies have not checked the activities of the feed wholesalers. According to the interview, the feed wholesalers have only limited knowledge about shrimp and feed quality. They simply accept the quality and the description of the quality that the feed companies provide. Of course, the feed companies instruct them on how to introduce their retailers or their farmers to feed quality. The wholesalers follow the instructions of the feed company technicians when helping the farmers to use shrimp feed efficiently and effectively. Therefore, the question is "what has been contributed by the feed wholesalers to the quality supply chain so far?" The answer is not clear and the feed wholesalers are merely a bridge to bring shrimp feed to the farmers, obtain feedback from the farmers and transfer farmer's questions to the technicians of the feed companies. Unfortunately, neither test company has included these activities as part of its product quality objectives.

As for shrimp culture techniques, technical staff of both feed companies and local extension can guide the farmers on how to culture high quality shrimp. The head of the farmers association said that most of the farmers seek consultation when it comes to shrimp culture techniques. However, they cannot apply the techniques accurately because of a limited level of education and the high cost of application. Moreover, technical guidance is still general and insufficiently specialized for different ecological conditions. The farmers requiring consultation on culture techniques, safety and quality should be helped by the extension centre.

5.3.2.3 Deficiencies with the shrimp wholesale buyer

All wholesale buyers of both Companies A and B are trained in quality control and storage techniques. They have a good awareness of the importance of shrimp quality to the companies' business. However, most quality problems at this stage are from collectors who collect and sell shrimp material to their wholesale buyers. In fact, wholesale buyers are unable to control and manage most of the activities of their collectors. Although the collectors have a basic knowledge of the quality control and storage techniques that are used by their wholesale buyers, their knowledge is still very limited. The collector injects physical and chemical substances into shrimp material. The wholesale buyers lack the equipment to test the samples and quality control is unscientific at best. They just test the samples by means of visual inspection. This is why the wholesale buyers cannot guarantee that their shrimp material is hazard free. Moreover, each wholesale buyer needs a large amount of capital to collect shrimp material. They will use their own money, either obtain a loan or obtain capital support from SFCs in advance. In many cases the wholesale buyers have lost faith in the ability of the collectors to produce good quality shrimp. So far the test companies do not provide support for the collectors. Their responsibilities stop with the wholesale buyers.

5.3.2.4 Other deficiencies

- ***Deficiencies at the VASEP***

Because both Companies A and B are VASEP members, they benefit from the many support activities for both product quality and safety that VASEP offers. VASEP organizes annual seafood trade shows for Vietnam's SFCs in Vietnam and abroad. It introduces Vietnamese seafood products and receives customer feedback. Both test companies have participated fully in the VASEP national seafood trade shows and they have succeeded in attracting new customers. In contrast, however, the test companies do not have a sufficiently large budget in order to organize their own trade shows abroad. Normally, VASEP will use the members' fund to organise a stand for all of its members at foreign trade shows. Over the last two years it has officially supported those Vietnamese SFCs participating in the Basa fish antidumping case and the shrimp antidumping case in the US market. VASEP has helped Companies A and B through the customs and excise formalities so as to export the products on time. Although VASEP has supported all SFCs equally, support needs of a particular SFC are still limited or responded to slowly by VASEP. In the supply chain stages, VASEP has focused mainly on SFC product quality, safety and international trade issues.

In addition, VASEP now has more than 186 SFC members. Their combined export value accounts for 90% of the nation's export. VASEP's activities include training in quality control, providing market information, and negotiating international business for all its members. However, there are still factors unresolved within VASEP that are acting against the quality control objectives. For instance, intense competition between SFCs when buying shrimp material in the MD makes it difficult to eliminate low quality shrimp simply because the farmers and the wholesale buyers have a ready market for all of their shrimp produce, no matter what the quality. Moreover, each SFC attaches more importance to its own interests than to the interests of the nation as a whole. Consequently, shrimp products are still affected by the hazards of shrimp production.

- ***Deficiencies at the NAFIQAVED***

As mentioned in previous chapters, the test companies benefit from the common policies and regulatory role of NAFIQAVED. For example, the shrimp production of Company A is less at risk from health hazards than Company B because the branch of NAFIQAVED in Saigon offers experienced staff who are highly skilled in the use of modern equipment and technology. As a result, NAFIQAVED has easily identified the health hazards of Company A's test samples. Company A achieves this advantage despite the high cost that it pays for the service. However, because tests are conducted on samples, the products that are not tested could still include hazards. Company B, however, pays little for its product inspection due to the distance between the company and the NAFIQAVED branch where there is a lack of modern technology and

equipment for testing. Thus, hazards are difficult to eliminate completely even in the test samples. Sometimes Company B has to take test samples of their products to the Saigon branch, but this takes a very long time and costs are high.

So far, seafood products in general and shrimp products in particular cannot be exported without NAFIQAVED's certificate. NAFIQAVED needs to enhance hazard tests for raw materials and final products, as well as periodic inspection of all HACCP implementation criteria at the company. In other words, it is difficult for SFCs in the MD to improve their quality control, to increase their knowledge of quality control, to update their market information and thereby meet their customers' requirements and expectations without support from NAFIQAVED. It is noted that the difference between VASEP and NAFIQAVED is that NAFIQAVED supports all stages of the chain from primary production to distribution.

In fact, NAFIQAVED is a bridge that links other stakeholders, such as local departments related to fisheries production, processing and trade, in the "fisheries quality assurance objectives" chain. However, there are only six branches of NAFIQAVED in the nation, and they do not have sufficient capacity to ensure effective support for all of the SFCs. This includes the NAFIQAVED branch in Ho Chi Minh City. Therefore, if the SFCs want to ensure that their shrimp materials and final products are free from the hazards, they have to test the products in some branches. These tests take time and create additional costs for the companies. In general, after receiving information about quality control from the NAFIQAVED branch, local departments distribute the information to the farmers and other related organizations. There is no further inspection, evaluation or feedback.

- ***Deficiencies in Fisheries Resource Development & Protection (FRDP)***

The main objective of the Department of Fisheries Resource Development and Protection is ecological balance. The mission is to protect and to develop the resources of the fisheries, the fisheries register of shipping and conduct inspection of the development and protection resources of the fisheries. In order to implement state management in the fisheries primary production, the Ministry of Fisheries issued the decree No.425/2001/QD/BTS dated on May 25, 2001 and two decrees No.05/2001/QD-BVNL and No.10/2001/QD-BVNL issued by the Department of Fisheries Resource Development and Protection. The decrees aim to enhance the right of the department to inspect the fisheries veterinary medicine and the fisheries commodity quality. This would mean the inspection of the fisheries seed, feed, medicine, chemicals, biological products, and tools/equipment used for fisheries production. To implement these tasks effectively, the department has to cooperate with other agricultural departments in the local government (the Department of Rural Development and Agriculture, the Department of Fisheries and the Extension Centre) so that all decrees are distributed across the industry at the same time. Furthermore, modern

technology is also installed to test fishery quality further through further analysis and experimentation.

However, because fishery quality issues in primary production are new to the department, there is not yet sufficient qualified staff and suitable equipment to cover these important areas. Particular areas of concern are the testing of fishery seed in general and shrimp in particular as well as the inspection of the fisheries' veterinary processes and feed production. Other disadvantages include (1) state management documents about fisheries' veterinary units not being distributed to primary production in a timely manner; (2) the scientific basis of the quality inspection is insufficient in that, for instance, there is no specific quality indicator for inspecting the fisheries' veterinary units; (3) the state budget for the FRDP activities is very limited. This issue limits inspection of the farmers and leads to a limited control of epidemic diseases. FRDP testing has covered approximately 60-70% of shrimp seed and environmental protection in the MD. So far, both test Companies A and B have not implemented any FRDP test. In order to implement quality management, the FRDP at local government level need specific information and motivation in order to expand their activities into the villages and districts where farmers are to be found. And, it is necessary to coordinate the activities of the FRDP and other local departments more strictly.

- ***Deficiencies in the Fisheries Department and the Extension Centre***

The Department of Fisheries and the Extension Centre contribute to the chain quality management via four missions.

Mission 1: Implementing State management functions in the hatcheries
- Stipulating the quality criteria of the fisheries' parents
- Inspecting the conditions of the seed business
- Creating a good environment for new seed businesses
- Organizing professional training for hatchery technicians

Mission 2: Implementing state management functions on the farms
- Support of culture techniques and preventive methods
- Guiding the use of shrimp feed, fisheries veterinary units, chemicals and biological waste products
- Ensuring a good water source for shrimp culture
- Providing information on seasonal scheduling and timing

Mission 3: Implementing state management functions in veterinary units
- Inspecting and certifying conditions for veterinary activities
- Organizing short training programs on fishery quality, hygiene and safety

Mission 4: Implementing state management functions in processing companies
- Providing imported processing technology and supporting documentation

- Providing good information on good shrimp material
- Inspecting and certifying the condition of fishery quality, hygiene and safety
- Issuing industrial standards, supplying acceptable amounts of and employing quantitative methods to monitor the use of antibiotics and chemicals in fishery products.

The Department of Fisheries and Extension Centre plays an important role in helping the shrimp farmers with culture techniques and other shrimp quality issues. For instance, they directly help the farmers follow the standards of the shrimp culture procedure. However, they lack sufficiently qualified staff to cover the above tasks. The Extension Centre staff admitted to shrimp quality problems during primary production. The problems are (1) the farmers are barely educated, so they are unable to remember the names of banned antibiotics; (2) the farmers did not write reports during the implementation of the shrimp culture as far as the chemicals used is concerned; (3) the farmers believe the shrimp seed wholesalers, so they buy shrimp seed at low prices without testing it; (4) the farmers lack awareness concerning public water source protection. This causes tremendous pollution and quickly creates disease. Disease leads to a low quality of raw shrimp material. Therefore, in order to contribute effectively to the framework it is necessary to combine the missions of local departments and help the farmers to produce high quality shrimp materials.

Regarding Mission 4 of the Department of Fisheries and Extension Centre, both Companies A and B have received supporting documentation for imported technology and information about quality and safety within the fisheries. Actually, in addition to Company A and B, SFCs in general would prefer the Department of Fisheries and the Extension Centre to focus on seafood quality and safety improvement in primary production, rather than on other stages of the chain, because these issues match their own roles and mission statements. SFCs are also supported by VASEP, NAFIQAVED, as well as by other organizations and institutions in quality assurance aspects. Therefore, to achieve good quality materials, it is necessary to integrate the quality objectives of the SFCs with the quality objectives of the Department of Fisheries, the Extension Centre and all other organizations and institutions. The resulting integration would contribute greatly to the quality assurance of final products at the SFCs.

5.4 Summary

The chapter demonstrates how to diagnose SFCs with respect to quality management in general and HACCP in particular. The test has been applied on two SFCs. Based on the test results, many gaps and deficiencies were identified. Gaps in quality were found inside the companies and various deficiencies were found in the stakeholder management of the shrimp supply chain (the hatchery, the nursery, the farmer, the feed wholesaler, and the shrimp wholesale buyer). In addition, the deficiencies at VASEP, NAFIQAVED, FRDP, the Fisheries Department and the Extension Centre were also described in detail. These gaps and deficiencies are the principal reasons why the companies should create plans to improve their product quality management, with respect to the manufacturing process and with respect to their supply chains. The improvement phase will be suggested in the next chapter.

Chapter 6

The Seafood Supply Chain Quality Improvement

6.1 Introduction

Chapter 4 dealt with the seafood SCQM framework. It mentioned measures to improve the seafood quality and safety in the entire chain. Chapter 5 focused on the diagnosis phase of the SFC part of the framework; during this phase, the SFC quality system was tested. The emphasis was on the testing of the HACCP system. Throughout the test many quality gaps and deficiencies were identified. These gaps and deficiencies need to be closed for further improvement. Therefore, as part of the framework, an intra-SFC quality improvement process has been developed (intra-SFC quality improvement measures). Section 6.2 discusses this SFC quality improvement implementation process.

In addition, finished products need quality improvement – not only at the SFC's but also during other phases of the chain (chain improvement measures). To realize chain quality improvement, the chain problems as formulated in Chapter 3 are used as a basis. These problems are used to structure an extensive round of interviews with chain actors and experts. Chain actors are interviewed to gain quality knowledge of the chain actor, status-quo of quality management and technology investment, implementation level of quality improvement, support level and capacity of other actors in the chain, hazardous test, local management in seafood safe and quality assurance. These topics are translated into questions for the chain interviews (Appendix 8). The relation of chain problems, chain interview topics and chain factors is shown in Table 6.2. Due to limited time, a chain test was not conducted. Therefore, all chain stakeholders' opinions are needed for the chain improvement. Chain interviewees include farmers, farmer associations, collectors, wholesale buyers, feed wholesalers, SFCs, NAFIQAVED branches, VASEP, the Extension Centre, Fisheries Department, and fishery experts. Interview results suggest potential measures to improve chain product quality and safety (excluding quality improvement measures in

the SFC). The chain measures to improve seafood safety and quality are presented in Section 6.3.

6.2 The intra-SFCs quality improvement measures and feedback

6.2.1 The intra-SFCs quality improvement implementation process

Chapter 5 has revealed that the quality management approach implemented in SFCs is not sufficiently systematic, because many quality gaps and deficiencies still occur during manufacturing. Therefore, a quality implementation process is needed for further improvement. Figure 6.1 displays the general process for implementing quality improvement in SFCs. This process includes nine steps:

- Having top management commitment (Step 1);
- Setting up the company's quality performance goals by top managers (Step 2);
- Implementing quality control management in actual practice (Step 3);
- Comparing implementation results with the company's goals and HACCP standards (Step 4);
- Identifying quality gaps and deficiencies (Step 5);
- Planning quality control improvement – Plan Stage (Step 6);
- Realizing the quality control improvement plan – Do Stage (Step 7);
- Observing and checking implementation results – Check Stage (Step 8); and
- Analyzing the results – Act Stage (Step 9).

In the process, a PDCA cycle is included to implement the quality control improvement plan. The PDCA cycle is a checklist of the four stages, Plan–Do–Check–Act. It describes the overall stages of improvement. During the first stage (*plan*), a plan to effect improvement is developed; during the second stage (*do*), the plan is carried out; during the third stage (*check*), the effects of the plan are observed; and during the final stage (*act*), the results are studied in order to determine what has been learned and what can be predicted (Deming, 1989).

Regarding SFCs in the MD, the cycle starts with the Plan Stage. The implementation of the improvement plan is the Do Stage. The Check Stage of the cycle measures the effects of the implementation of the improvement plan as compared with the Plan. During this stage, quality control company performance goals, including HACCP procedures and principles, are used to confirm the effects of the implementation of the improvement plan. Next, the cycle moves on to the Act Stage to investigate and analyse whether more changes are necessary. If the improvement has been successful, the cycle continues to the Plan Stage, because the quality control improvement implementation should

affect the company's quality performance goals in general and the HACCP norms in particular. If not, the cycle will start all over again. The information in the Act Stage is also used to formulate further improvement plans by the top management. The process should then start all over again, following the nine steps.

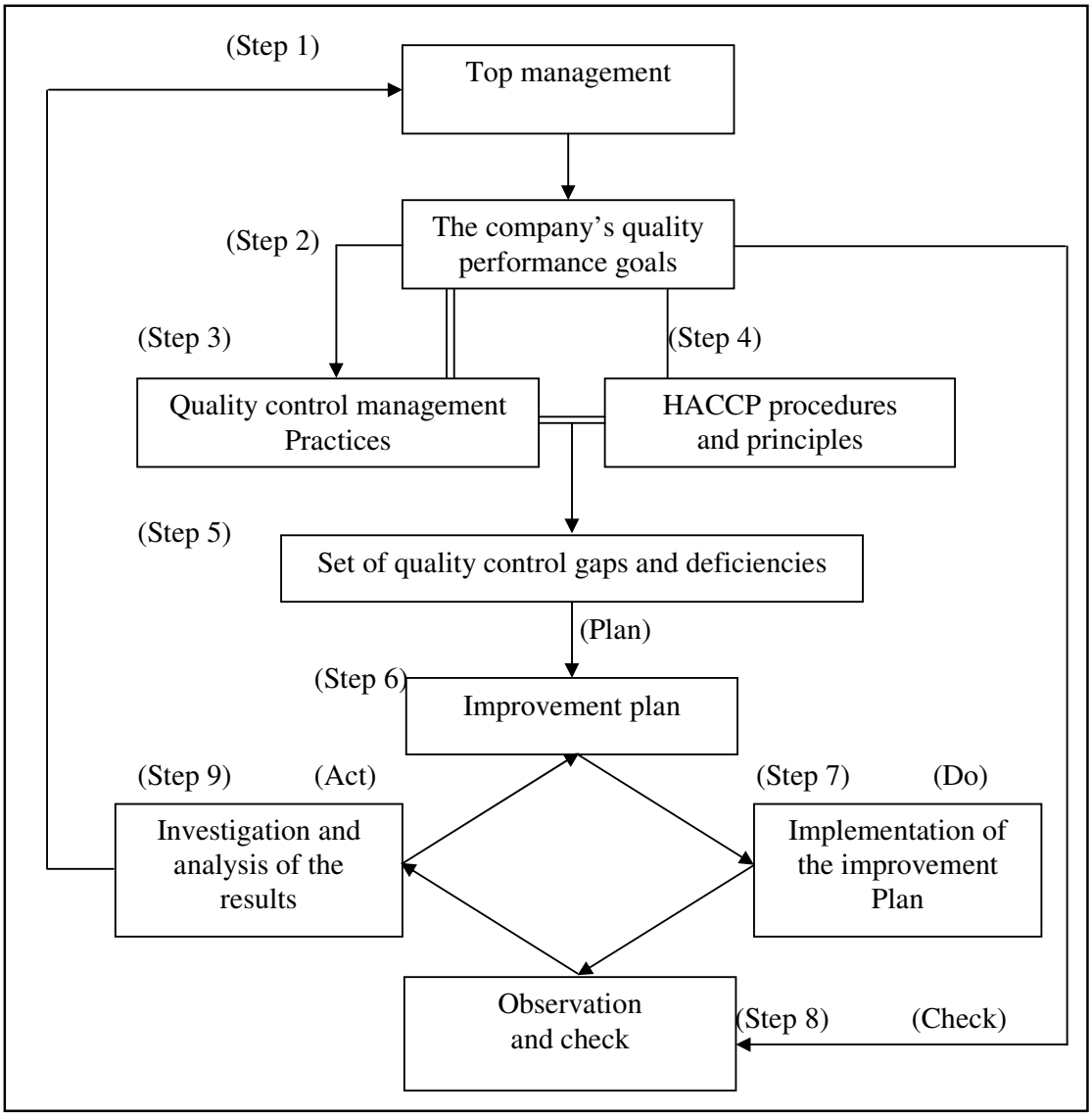


Figure 6.1 The quality improvement implementation process

It is noted that there can be two reasons for the SFCs to start the entire process again. First, the company's quality performance goals may not have been achieved after implementing the PDCA cycle. Second, there may have been changes in the quality standards set by the Ministry of Fisheries, international

trade, and customers, so that SFCs had to set up new quality performance objectives. In an ideal world, the process could stop at Step 3 if there are no gaps and deficiencies when comparing the company's quality control performance goals to quality control management practices. However, according to the survey none of the SFCs were in an ideal situation. This means that the entire process is needed for all SFCs in the MD to improve their product quality. The following subsections will explain the whole process in detail.

6.2.1.1 Step 1: Top management commitment

Top management commitment is an important factor that determines the success of business performance in general and HACCP implementation in particular. The implementation of a quality control improvement plan is the responsibility of top managers, therefore they need to become immersed in it. Without commitment from the top management, the process cannot be implemented, and nothing significant will take place (Zhang et al., 2000). It is also essential that the top management is personally involved in implementing this process. If they fail to be involved, the implementation process is likely to stagnate and disillusion will set in among employees. In addition, top management must provide sufficient resources such as time, personnel and capital in order to ensure the successful implementation of the process. Furthermore, top managers should study the quality control improvement implementation process in order to have a better understanding of how to apply and monitor improvements. In particular, they should understand that the HACCP program is a long-term, rather than a short-term implementation process. Without a profound understanding of HACCP implementation practices, the most effective quality control improvement plan cannot be developed. Regarding Companies A and B (test companies mentioned in Chapter 5), while top managers of Company B can decide on all business activities, Company A's decision-making sometimes has to wait for solutions from the government because it is owned by the state.

6.2.1.2 Step 2: The company quality performance goals

Top managers at the company receive the fishery quality standards and criteria from the Fisheries Industry, customer's quality requirements, and quality information from fishery export markets, and from VASEP and NAFIQAVED. All this information shall be considered by the top management in order for them to set up the company's specific quality control performance goals. All SFCs in the MD have their own quality performance goals in terms of input of raw materials criteria, GMP and SSOP standards, and HACCP criteria. Some of them have TQM and ISO standards, BRC standards, and SQF code. In particular, the criteria of HACCP standards in the two test companies were set up as a twelve-stage procedure for HACCP implementation. During production time, the criteria of HACCP standards in each process of the procedure were observed and inspected by managers.

6.2.1.3 Step 3: Quality management practices

In practice and on the basis of commitment by the company's top management the diagnosis of the quality control management framework is conducted. SFCs perform quality management diagnosis in their own way in order to achieve the quality objectives. Implementation results of the framework diagnosis are evaluated quarterly, every six months or annually according to the company's business plan.

6.2.1.4 Step 4: Evaluation of quality control management practices

For this research and after testing, an assessment was developed on the basis of a comparison between implementation results and the company's goals, and the HACCP procedures and principles. Throughout the assessment (Section 5.2), it will be easy for the company to identify its strengths and weaknesses concerning the implementation of quality control. The assessment will be able to provide an effective and efficient way to identify areas for improvement. Parts C and D of Appendix 7 show the indicators for the assessment and the methods for using it. In addition, the company will be free to develop its own specific measurement system which it more suitable to measure employee satisfaction, product quality, customer satisfaction, and strategic company performance. This system can be used to evaluate HACCP implementation practices and to measure the company's implementation progress over time, and it will quickly reveal priorities as to which areas need to be improved.

6.2.1.5 Step 5: Set of quality gaps and deficiencies

The assessment results provide a snapshot of the company's quality gaps and deficiencies. Section 3 of Chapter 5 presents the quality gaps and chain deficiencies of two test companies. Through such analyses, the companies can devise potential quality control improvement measures (improvement plan) to cover their quality gaps and deficiencies for achieving the company's quality objectives.

6.2.1.6 Step 6: Formulation of a quality control improvement plan

The company's quality gaps and deficiencies are among the keys on the basis of which a quality control improvement plan can be made. Because the quality control improvement plan is a step in the improvement process, the actual implementation of a quality control improvement plan will lead to success with the process. However, there are many factors that affect the implementation of quality control improvement. These factors include targeted areas of overall company performance, the company's available resources, an understanding of the company's current situation, time schedules for the plan's implementation, and responsibility for the implementation of quality control improvement throughout the various functional departments.

First of all, the implementation of quality improvement cannot be separated from targeted areas of the company's overall performance, since its major aim is to improve overall company performance in general and product quality in particular. Based on the targeted improvement areas, feasible improvement possibilities should be identifiable; a good understanding of these is a prerequisite for formulating the most effective quality improvement.

The second factor that affects the implementation of quality control improvement concerns the company's available resources. These are personnel, information, capital, company infrastructure, and employees' levels of education and skills. In fact, the company's resources are limited. In order to use the limited resources more wisely, SFCs should select improvement possibilities that will effectively bring improvements to HACCP practices and the company's overall performance. In order to understand the company's available resources, the HACCP team should have a better understanding of the company's current situation. Thus, information from relevant functional departments within the company is necessary. It should be noted that resources needed to implement feasible improvement possibilities vary for different companies. In contrast, it is not always wise to implement several improvement possibilities at the same time, even if the company has sufficient resources to do so, as this may lead to the company losing its focus.

The time schedule for implementing quality improvement is very important – in fact, one might say that it will never be completed. The time dimension involves information on time for preparation (for example, training, communication, announcements within the company, etc.), the actual starting time for the implementation, observing and checking the results of implementation, investigating and analyzing results. The time dimension can be used to guide the company in its implementation of quality improvement. It should be noted that a rapid change in the company's normal practices can produce negative results. A gradual, step-by-step procedure is highly recommended, with the implementation team setting a careful schedule for implementing quality control improvement.

Finally, responsible departments and people should be involved and informed about the time required to implement the improvement plan. In this regard, the selection of people should be based on their experience, skills and potential contributions to the quality implementation.

6.2.1.7 Step 7: Implementation of an improvement plan

In order to implement quality control improvement, the PDCA cycle tool (Deming, 1989) is applied. With this tool, improving HACCP implementation and the company performance becomes a never-ending process. It is necessary to complete the cycle in order to arrive at "problem solved." Go back to the Plan stage in order to identify the next "problem faced." If the experiment was not successful, skip the Act stage and go back to the Plan stage in order to come up

with some new ideas to solve the problem and go through the cycle again. What follows summarizes practices of PDCA cycle implementation by SFCs in the MD.

However, at the moment the two test companies have not applied the PDCA cycle to implement any plan. Employees from the Planning Department set up the business plan including quality objectives at the beginning of the every year. Setting up the plan was based on the specific plan of the company's functional departments. At the end of every quarter, every six months and each year the company's departments report on all business situations. Although assessment is considered quarterly, corrective actions still take time to be carried out. Company B can take corrective action (not PDCA implementation) much faster than Company A. Company B has decentralized quality control management into a Department of Quality Control, and it can make corrective decisions quite quickly to achieve quality objectives and customers' quality expectations. Company A's corrective decisions, however, still depend on the top managers or higher authorities from the state.

Top management should be committed and it should continue to support the quality control improvement plan of the company. This is essential to the success of plan implementation. In order to ensure the success of implementation, it is just as important to educate and train the employees involved. Moreover, sufficient resources should be provided for implementing the plan. Top management should allow the improvement team in the Department of Quality Control to start up the improvement plan. Being part of the quality improvement plan, the improvement team can effectively undertake specific actions in each area of the quality improvement plan. At the moment (2003) neither Company A nor Company B has formulated a specific quality improvement plan. They have simply followed the plan at the beginning of the year and they have assessed it quarterly. Because of time limits this study could not plan the quality improvement for the two test companies. The study only describes the quality improvement process in order to guide the companies in formulating it and in order to show them how necessary this process is in their quality improvement. Therefore, the companies should try to formulate quality improvement plans on their own in order to implement their own quality control improvement.

6.2.1.8 Step 8: Check on implementation

The implementation of the quality improvement plan needs to be continually monitored or checked in order to ascertain whether the implementation process is going according to plan. It is noted that checks are included for immediate results of implementing the quality improvement plan in order to understand whether the system is functioning. In addition, the effects of implementing the quality improvement plan in the company's performance goals should be checked. There is no use implementing the quality improvement plan if the

overall company performance cannot be improved. In other words, in the Check stage, company quality control performance goals and HACCP procedures and principles should be used to confirm the effects of the implementation of the improvement plan. Check results will be analyzed, and the process can move on to the Act stage. Companies A and B quarterly check their implementation based on the company's plan, but not the quality control improvement plan. The reasons for this are that both of them had set up their business plan only at the beginning of the year. After every quarter, they compare the implementation results to the plan. If something differs from the plan (gaps have happened), they would adjust the plan for the next quarter rather than develop the improvement plan.

6.2.1.9 Step 9: Analysis of implementation results

After checking the implementation of the quality control improvement plan, the company can obtain data and information on the implementation and its effect on the company's overall performance. It is essential to analyze the results obtained during the Check stage. An analysis of the results will reveal whether the implementation of the plan effectively improves HACCP practices or overall company performance. If it can be concluded from the analysis that the implementation has not been effective, a new improvement plan has to be submitted to the top management; and then the PDCA cycle returns to the Plan stage in order to search for other quality improvement plans that may have better effects. Hence, the PDCA cycle should lead to a never-ending process of improvement.

In short, SFCs in general test companies in particular have not completely applied the PDCA cycle to their quality control improvement plan. The implementation of quality improvement is, however, affected by several factors. These factors can affect the implementation of quality control improvement on different levels. SFCs should understand their current situation and then determine which factor really influences the implementation process in their quality improvement plan. In other words, there is no perfect way to implement this process. SFCs differ because of their people, managerial capacity, employees (qualifications and skills), culture, history, goals, structure, products, services, technologies, processes, and operating environments. Therefore, they should combine their own uniqueness with this process and consequently develop their own ways to excellence. The main thing is to focus on the practical implementation so that the companies can optimize the use of this process by blending it with and applying it to their own situation, using the methods that best suit their situation.

6.2.2 Feedback about the SFC quality improvement implementation process

Receiving the feedback took place at a meeting of the two test companies. Participants of the feedback meeting included test company members, their chain stakeholders, the deputy in the local fishery department, researchers, other SFCs, the VASEP, and the NAFIQAVED.

At the company level, the participants expressed that they agreed with the procedures of the quality improvement process (figure 6.1). They emphasized that the process in practice had specific steps for application. They also noted that the role of the top management in making decisions for the company's quality changes was crucial. The top managers of both companies were willing to change and provide support with respect to product quality assurance and improvement. They suggested that the department of quality control basically should be responsible for learning and implementing the process, establishing and implementing the quality management framework, comparing implementation results with the plan and the company's quality objectives, identifying quality gaps and deficiencies, establishing an improvement plan along with a set of improvement measures, implementing the plan, checking and analyzing the plan, and using the PDCA cycle for continuous improvement. To do all of this, the companies should educate their employees on managerial skills and statistics so that they can monitor and control the quality improvement effectively and fully apply the PDCA cycle. Furthermore, a participation link of all employees in different departments is crucial to achieving the company's quality objectives.

The success of some large SFCs in the MD in realizing seafood quality and safety improvement is modern technology investment, completed implementation of quality management systems, and the participation of qualified staffs and workers. Participants of the meeting agreed that these should be company factors (Figure 6.2):

- Managerial improvement measures related to organizational behaviour vis-à-vis quality would take time for SFCs. Moreover, it would not be easy to implement the quality focus factor at present. For instance, there was not enough time to organize specific training programs for each group of the company's employees. However, the quality focus factor could be performed on a step-by-step basis in the long term. In addition, the companies could arrange for all levels of managers to be trained, but this would also require time and money. The top managers emphasized that if managerial knowledge and skills at all levels of management were to be improved, the organizational attitude towards quality would be better.

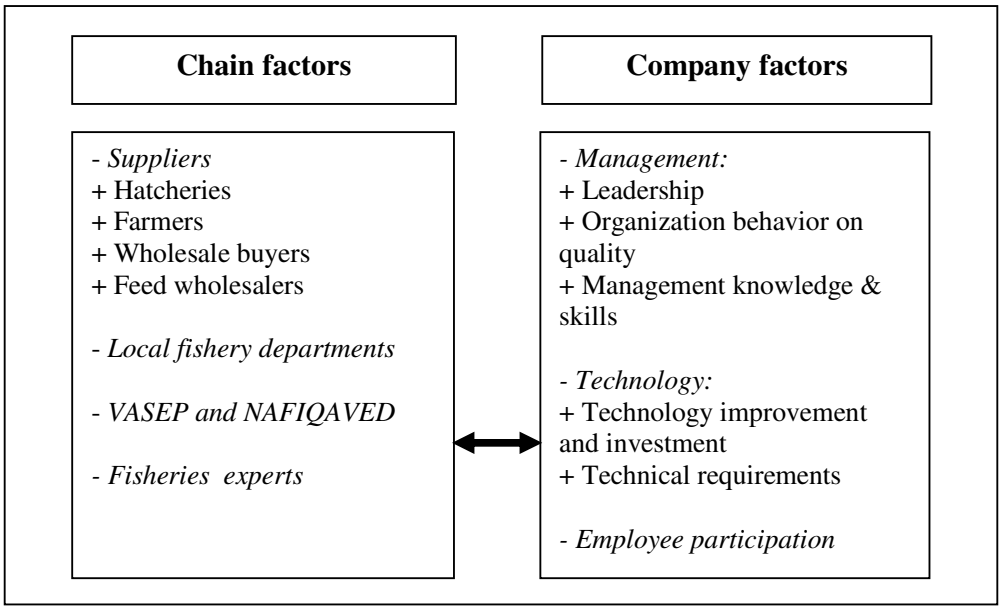


Figure 6.2 The seafood supply chain factors

- Technological improvement can only be implemented in the long run if the companies have enough money (e.g. industry investment or company equitization). At present, because of internal competition the companies have difficulties collaborating with other SFCs in order to test for hazards. According to the companies, the Fisheries Industry should invest in modern test equipment at all NAFIQAVED branches and at each provincial fishery department, or regional SFCs could buy the testing equipment together. This would help the SFCs reduce testing costs and ensure product quality. In the short run, in practice the application of HACCP principles has revealed different interpretations. At company level, many CCPs are established for product safety assurance during the processing procedure of the company because of the poor condition of equipment and machinery. Therefore, technological innovations should be invested in, on order to improve the safety level while reducing the number of CCPs. Moreover, international differences exist in the acknowledgement of HACCP certificates, which hinder international trade. ISO should be applied as a norm for international food safety. Also, Vietnam's food industry is faced with a lot of requirements that are set by the government and customers. These requirements are not only different, they also change regularly in order to meet international trade quality demands. It should be noted that a certificate is often considered an ultimate goal. This certificate is then used as some kind of protection

against external interference and as a defence instrument, rather than to assure customers concerning quality. There should be an application of HACCP principles and risk assessment support in selecting technological CCPs. It is important that the identification of these CCPs is performed together with the people that are involved in the very processes. A single focus on procedures is not advisable because that would have its limitations in directing human behaviour.

- Employee participation measures relating to HACCP implementation practices depend on the companies' unique conditions. The companies were very interested in these measures in terms of (1) training for managers and employees on quality control awareness; (2) controlling technological standards at each production group; (3) concretizing the daily responsibilities of the HACCP team; (4) enhancing statistical knowledge and analysis skills at all levels of management; (5) strictly implementing and monitoring each CCP. The companies will consider and apply the above points as soon as possible when it comes to product quality improvement.

6.3 Seafood chain quality improvement measures

During the SFC meetings, the participants also expressed their opinion on the possibility to improve chain product quality. Subsection 6.3.1 will present the suggestions made during these meetings. These discussions and suggestions were useful but insufficient to build a complete view. Therefore, interviews with chain actors and experts were necessary. Subsection 6.3.2.1 will describe the plan of the interviews. It includes the interview schedule and tools, the relation of interview topics with chain problems and chain factors. The interview questions are described in detail in Appendix 8. The interviews suggest possibilities for seafood chain quality improvement. Subsection 6.3.2 will present the chain actors' opinions on seafood chain quality improvement.

6.3.1 Feedback about chain quality improvement of the SFC meeting participants

At the companies' meetings the participants agreed on the importance of the role of all chain factors (Figure 6.2). However, the SFCs expected much more VASEP and NAFIQAVED support activities in their businesses. At present, the support of VASEP and NAFIQAVED is essential in fishery quality assurance and improvement in general, and shrimp in particular – throughout the supply chain from primary production to distribution. Yet, while VASEP support activities are macro activities, they still limit their support to specific companies. Although VASEP organizes official meetings for its members annually, quality

problems due to competition among SFCs have still not been resolved yet. On the other hand, quality managerial training by the VASEP is not related to specific situations at the SFCs. Thus, it is not easy for SFCs to apply effectively what they have learned. The companies suggested that quality training should be organized regionally and that it should solve quality problems in regionally specific conditions. In addition, support activities from the regional VASEP branches are rather passive. Therefore, SFCs seldom send their feedback to the VASEP branches, because SFC problems are not solved in time. Similarly, regional NAFIQAVED branches do not have the capacity to test or inspect for hazards in the entire chain, so the companies have to spent time and a lot of money on testing raw materials and final products in HCMC. The companies also emphasized that while SFCs could not control the product quality of their suppliers, quality control activities in primary production depend on state management as represented by local fishery departments. In addition, fisheries quality control activities in primary production are not coordinated among local fishery departments and they are not linked with company quality objectives. As a result, there is a separate management for fishery quality assurance during primary production. They suggest that it is necessary to bring all chain actors together to develop effective chain quality improvement measures. The following section presents the chain quality improvement measures that resulted from the chain interviews.

6.3.2 Chain quality improvement measures

This subsection presents the results of the interviews with chain actors and experts (Subsection 6.3.2.2). First, Subsection 6.3.2.1 describes how the interviews were planned and structured.

6.3.2.1 The plan of interviews

Making the interview plan aimed at achieving information from the seafood supply chain for formulating potential measures to improve chain product quality and safety. Chain interviewees included farmers, farmer associations, collectors, wholesale buyers, feed wholesalers, SFCs, NAFIQAVED branches, VASEP, the Extension Centres, Fisheries Departments, and fishery experts. See Table 6.1 for an overview.

Table 6.1 The interview schedule and tools

Time	Interviewee	No. of sample	Interview Method
Oct.2-4, 2005	Farmer/ farmer association	4	Directly by open questions and focus group
Oct.5-6, 2005	Collector	6	Directly by open questions
Oct.7, 2005	Wholesale buyer	4	Directly by open questions
Oct.8, 2005	Feed Wholesaler	2	Directly by open questions
Oct. 9-11, 2005	Seafood company	6	Indirectly by telephone, email
Oct.12, 2005	NAFIQAVED branches	2	Directly by open questions
Oct.13, 2005	VASEP	1	Directly by open questions
Oct. 14, 2005	Extension Centre	2	Directly by open questions
Oct.14, 2005	Fisheries Department	2	Directly by open questions
Oct. 15-19, 2005	Expert	5	Directly open questions and indirectly by email and telephone

The roles of the different actors and the problems in the chain described in Chapter 3 and structured in Chapter 4 were the basis for the interview topics; see Table 6.2. The questions are described in detail in Appendix 8. More specifically, the actors were asked about their responsibilities and tasks in the fisheries quality management and implementation as well as about aspects in relation to fisheries management, technology, equipment, culture techniques from support organizations and local departments. To conduct the interviews we used tools such as the telephone, e-mail, and face to face communication. First, phone calls were made to directly contact chain actors in order to make an appointment for the interview. Next, the questions were sent to the interviewees by e-mail. SFCs and some experts replied by e-mail. If something was not clear or not mentioned, the phone was used. Other actors in the chain were interviewed face to face. The results of the interviews are mentioned in Subsection 6.3.2.2.

6.3.2.2 Seafood chain quality improvement measures: interview results

Interviewed SFCs noted that different culture forms (Appendix 5, Part 3) relate to different distribution channels. In case of industrial and semi-intensive cultures, shrimps are directly sold to wholesale buyers. Thus, shrimp quality is absolutely safe when the shrimp is sent to the SFCs. Shrimp materials from an extensive culture are distributed from small collectors to large collectors, to wholesaler buyers and then to SFCs. In such case, shrimp quality and safety are not ensured because the journey takes a long time and includes more steps. The SFCs indicated that almost all collectors want a high profit from their business and they reduce their costs by using unhygienic and unsafe storage conditions and by injecting various substances to increase shrimp weight. Moreover, due to

high competition in the purchase of shrimp materials between local SFCs and SFCs in HCMC and other provinces, it is difficult for SFCs to request for high quality materials; they can only purchase them at higher material prices.

Table 6.2 The relation of chain problems, interview topics and chain factors

Chain problems	**Interview topics**	**Role of chain factors affecting**	**Interviewees**
1. At hatchery and farm • Quality knowledge limits • Lack of technology • Low seafood parent quality • Uncontrolled import seed • Diseases • Shrimp feed • Environmental pollution • Chemical use	. Training . Technology investment . Local quality management . Support organizations . Hazard test	. Hatchery itself . Farmer itself . Fisheries department . Extension Centre . NAFIQAVED . FRDP . Feed wholesaler	. Farmers . Farmer association . Fisheries department . Extension Centre . NAFIQAVED . Feed wholesaler . SFCs . Experts . Collectors . Wholesale buyers
2. At collector/wholesale buyer stage • Quality knowledge limits • Chemical injection • Lack of maintenance means • Unclean means	. Training . Technology investment . Local quality management . Support organizations . Hazard test	. Collector itself . Local government . SFC . Wholesaler buyer	. SFCs . Fisheries department . Extension Centre . NAFIQAVED . VASEP . Experts . Collectors . Wholesale buyers
3. At distribution stage • Storage conditions • Transportation conditions	. Training . Quality management . Hazard test	. SFC . Collector . Wholesale buyer . VASEP . NAFIQAVED	. SFCs . Collectors . Wholesale buyers . VASEP . NAFIQAVED . Fisheries department . Experts

Representatives of the Department of Fisheries and the Extension Centre said that Vietnam Fisheries Industry and its dependent organizations including NAFIQAVED have issued hundreds of decrees, rules and regulations for fishery safety and quality management. Local governments and the Department of

Fisheries are responsible for communicating these regulations to farmers, production organizations, SFCs, and the relevant managerial units. They also manage and inspect the implementation of these rules. These documents are also updated to meet changes in import market changed requirements as well as international trade rules. To be specific, local government and the Department of Fisheries use methods to propagate the decrees, rules and regulations. These methods included handing out flyers at crowded places, handing out documents to farmers, extension trainings, and feed companies' seminars. However, both local departments and the Extension Centre are unable to check whether farmers use antibiotics in production, which is one of the reasons why there are still antibiotics in final products. Other reasons are that (1) large amounts of banned antibiotics are still sold in the free market; (2) the fact that farmers' habits in using banned antibiotics are not easy to change; (3) substitute products of the forbidden antibiotics are highly priced; and (4) it is difficult for the farmers to distinguish whether antibiotics are banned. The Fisheries Department and its Extension Centre do not have enough equipment and money to test for hazards. In particular, postharvest activities and storage at the field affect shrimp safety and quality. For instance, water quality to wash the shrimp, ice to store the shrimp, and the harvesting environment are unhygienic. Moreover, storage is used many times without cleaning, which can easily lead to infection during transportation from the farmer to the wholesale buyer and to the SFC. The Department of Fisheries and the Extension Centre also emphasized that one of their tasks is to manage and control the quality and safety of shrimp seed but that they cannot perform their task under the present circumstances because (1) the small-size hatcheries developed too fast to meet the seed demand of the MD, and because of (2) limited human resources and budget for the management of the Extension Centre.

Therefore, in order to improve seafood safety and quality in primary production, both SFCs and local departments (Fisheries Department and Extension Centre) suggest to:

- enhance the inspection of veterinary production units, veterinary wholesalers, and imported veterinary products;
- inspect the use of antibiotics in fisheries culture procedure, especially in field preparation;
- increase budget, staff and equipment for sample collection and hazard testing;
- develop centralized culture fields and apply SQF standards to these fields;
- test samples frequently and help farmers harvest on time without using antibiotics;
- educate farmers, collectors and wholesale buyers with respect to product quality and safety;
- forbid strictly the use of agar, powder water, rice water, stick and nail;

- establish large companies for seed production under both forms – state or private – to make it easier to acquire capital, to develop management, to invest in modern technology and to apply HACCP;
- establish large culture cooperatives to achieve supports in terms of input-output process, product inspection, techniques, capital, management and technology as well as environmental protection; and
- develop common policies on material price and quality between SFCs to prevent farmers from selling low shrimp quality and to encourage them to produce high quality shrimp.

In addition, according to two interviewed farmers and members of a farmers' association who cultivate large scale of shrimp successfully with high quality products and price, supported by an Extension Centre:

- the farmers need to be trained extensively on culture environment and techniques and they have to apply them strictly;
- it is necessary to be careful with respect to the quality of industrial feed and other added feed;
- shrimp seed must be of a good quality;
- farmers should use biological products instead of antibiotics in culture environment management.

Regarding shrimp seed, the SFCs emphasized that it is necessary to establish large scale centres or companies for high quality seed production. At the moment all hatcheries in the MD are quite small. They lack the basic infrastructure for good seed production, technology, test equipment, and qualified staff. At the same time, imported seed from abroad and other regions is not controlled and quality is not ensured.

Moreover, the large SFCs in the MD that were interviewed attributed their successful experiences with respect to high quality material management to the fact that they have loyal wholesale buyers. These wholesale buyers are supported by the SFCs in terms of means, capital and techniques to buy and test shrimp materials. They are also taught how to buy high quality materials from their collectors and how to refuse low quality products. Also, the large SFCs have invested capital, techniques and strict quality control in large shrimp culture fields. These fields have provided a large percentage of high quality shrimp materials. However, smaller SFCs do not have sufficient resources to apply the above measures. Thus, two important suggestions made by the large SFCs are that the Fisheries Industry and the State should (1) invest in the development of a fisheries infrastructure (e.g. independent water system, large field planning) to achieve sustainable fisheries culture environment, and (2) develop centralized culture fields in order to receive managerial, technological and technical supports from local government, fisheries departments,

NAFIQAVED, the Extension Centre, and SFCs concerning high quality material.

NAFIQAVED representatives mentioned that there are two NAFIQAVED branches in the MD, located in Cantho and Camau. Normally, SFCs and farmers in the MD will test their products at these two branches. Each branch is responsible for a monthly field hazard test, a sample hazard test of farmers' products, and a sample hazard test of the final products (100 ton/sample/category). However, it is difficult for the NAFIQAVED branches to test samples of individual farmers at their fields due to time and money. According to the import market requirements, hazard test requirements are different from country to country. For instance, the US market only allows a very limited amount of six substances in the final products, while the EU market allows more than 40 substances. The representatives emphasized that although many chemical residues are not allowed in the final products, in three years three typical residues have been found that worry import markets most: the residues of Cloramphenical (2002), Nutrofuran (2004), and Fluoroquinoles (2005). Because of the restricted testing capacity in the MD, in some cases SFCs have to test their final products in a HCMC branch. Anyway, sample product tests are not completed before exporting. Moreover, NAFIQAVED branches sometimes face urgent changes to a zero level of some residue or new substances discovered by import markets. Therefore, the following recommendations are emphasized by NAFIQAVED representatives:

- It is necessary to culture shrimp on a larger scale under different forms like farmer groups, farmer associations, cooperative and farm, because these forms can ask for support from local managements, the SFC's quality control, the Extension Centre, and NAFIQAVED more easily.
- Cooperation between NAFIQAVED, local fisheries departments, research institutes and university in the region with respect to testing should be developed. For instance, Cantho University has invested in some very modern equipment, namely the LC-MSMS (US$400,000). This equipment automatically tests a sample twice for certain hazards, but this equipment is so very expensive that the NAFIQAVED system has not yet invested in it.
- Local governments, local fisheries departments and Extension Centres should enhance integrated activities to train on quality managerial knowledge for local staff, the community's consciousness on fisheries safety and quality, and the implementation of laws on safe and quality management in every province.

Fisheries experts in the MD who were asked about their experiences and who were asked for suggestions to improve chain fisheries quality and safety, emphasized that:

- VASEP should develop an appropriate price policy for SFCs to avoid purchase of bad quality materials;
- SFCs should enhance the implementation of input-output contracts (SFC invests in shrimp production and also buy raw shrimp products) in primary production; and
- it is necessary to develop farmer organizations such as farmer groups, farmer associations, and cooperatives for both support goals, i.e. quality management and technology investment. These farmer organizations van be supported easily by the local management, the Extension Centre, the SFC investment in quality control and technology and equipment as well as quality training. Furthermore, input-output contracts will be more attractive with high quality products to collectives than to individuals.

Finally, the suggestions and recommendations of the interviewees are also confirmed by 295 shrimp experts from 25 countries at the conference of Global Shrimp Outlook (GSOL, Oct. 2005) that was held in Vietnam. They indicated that there are three important challenges to Vietnam's shrimp industry for the next few years. These are (1) to invest in modern technology in order to meet high safety and quality requirements in the world market, (2) to reduce shrimp production cost, and (3) to culture shrimp sustainably with high technology and management to eliminate hazards and protect the environment. They also noted that Vietnam's shrimp industry needs to be developed sustainably on a large scale, because Vietnam's shrimp production is still very small-scale and it lacks co-operation. For instance, the co-operations between farmers and farmers, farmers and support organizations, farmers and SFCs, SFC and SFC have not been considered sufficiently. As a result, it is difficult to achieve high quality and safety in shrimp production as well as gain big contracts with import markets and supermarket chains with small-scale culture and production. Therefore, the above mentioned co-operations should be taken into account by the Fisheries Industry in order to improve shrimp quality and safety to integrate the world's shrimp market in the future (GSOL, 2005).

6.4 Summary

This chapter discusses the possibilities to improve shrimp quality. These possibilities are embedded in the supply chain quality management framework as introduced in Chapter 4. The possibilities are divided into company factors which are mentioned in the case studies in Chapter 5. The basis for the improvement measures with respect to the chain factors are the interviews with chain actors and experts. For more overall improvement possibilities, the next chapter will deal with research conclusions and recommendations.

Chapter 7

Conclusions and Recommendations

7.1 Introduction

The research is implemented in eight steps and presented in seven chapters. The first six chapters provide the research background, methods and methodology (Chapter 1), literature review (Chapter 2), company survey (Chapter 3), the SCQM framework (Chapter 4), the framework test (Chapter 5), and the seafood supply chain quality improvement measures (Chapter 6). This chapter draws conclusions and provides some recommendations. Chapter 7 is divided into an introduction, conclusions of research products, and recommendations for seafood quality improvement. Next is a section on the changes that have taken place since the start of the project. The final section presents recommendations for further research.

7.2 The main research findings and conclusions

The most important research findings relate to (1) the importance of HACCP systems in food quality assurance, (2) the survey regarding the quality problems of the shrimp supply chain in the MD, (3) the seafood supply chain quality management framework, (4) the SFC case studies (5) the SFC quality improvement process, and (6) the interviews concerning the chain quality improvement measures.

7.2.1 The importance of HACCP systems in food quality assurance

One of the most important tools in food quality and safety assurance is the HACCP program. HACCP – an approach to processing quality control and food safety – is used in the food industry. It is a prevention-based system and it aims to identify all possible hazards.

Within an HACCP system, potential hazards are identified and risks are analyzed during each phase of production, critical control points for preventing such hazards are identified and constantly monitored, and corrective actions are taken when necessary. Record keeping and monitoring procedures are used to ensure that the system is working. It involves examining and analyzing every stage of a food-related operation in order to identify and assess hazards, determining the "critical control points" where action is required to control the identified hazards and establishing the critical limits that must be met. It also involves the monitoring procedures that are needed at each critical control point and the establishing of corrective procedures when a deviation is identified through monitoring of the HACCP.

A proper HACCP system necessitates a combination of a technological and a managerial focus. Such a techno-managerial approach for food supply chain safety and quality management is mentioned by many authors. This research relies mainly on the approach of Luning et al., (2002).

7.2.2 The survey results

The survey concerned 32 SFCs in the MD. Conclusions of the survey results focus mainly on seafood supply chain quality management by the hatcheries, farmers, collectors/wholesale buyers, SFC processing and distribution. Many quality managerial and technological problems within the SFCs and their supply chains have not been managed and controlled completely. In addition, the role of the government, the Fisheries Industry and the support organizations for chain quality assurance and improvement are crucial.

- Most of the hatcheries in the MD are of a small size. These small hatcheries lack modern technologies and do not have sufficient possibilities to invest. At the same time, the capacity of the larger hatcheries is insufficient to provide high quality shrimp seed for the regional demand. Moreover, both Fisheries Industry management and company quality management have not been able to control any quality activity of the hatcheries. Low quality shrimp seed carrying disease germs has been marketed to the MD through uncontrolled sources.
- Although farmers in the MD are supported by the local government, the Department of Fisheries, FRDP and the Extension Centre in terms of culture techniques, knowledge of product quality and safety, shrimp materials still involve hazards. On the one hand, the farmers themselves do not feel responsible for ensuring product quality or they apply culture techniques insufficiently by using forbidden antibiotics. On the other hand, the Department of Fisheries and the Extension Centre have not enough qualified staff and equipment to impose these responsibilities in a large region.

- Collectors and wholesale buyers are chain actors who buy shrimp materials from the farmers and sell them to the SFCs. These chain actors – mainly collectors – lack quality knowledge (they even mix injections into the materials themselves), test equipment, storage techniques, and means. These are important reasons affecting shrimp quality.
- Because SFCs in the MD lack the conditions and methods to manage and control product quality within the company and its chain, seafood products in general and shrimp products in particular may still be infected by antibiotics, biological and other contaminants. In other words, the infections can happen anywhere – from upstream to downstream in the supply chain, from fingerling quality, raw material source, transportation, processing, warehousing, inventory, facilities, technology, packaging, to distribution. These problems relate to the HACCP implementation within the company. Almost all SFCs in the MD applied the HACCP system though not sufficiently, as quality control, processing technology, and test equipment are limited. Thus, shrimp final products have been infected during the processing procedure, from inputting shrimp material to the storage of final products. At the distribution stage, the SFCs are only able to control the quality issues related to transportation and storage. The moving time of shrimp material throughout the chain and the storage time very much affect the shrimp quality. In most of the survey cases, the distribution of shrimp materials from farmers or from offshore to the company takes a long time. For instance, it takes three to seven days if the SFC is located far from its material source.
- The Fisheries Industry, local fisheries departments and support organizations play an important role in chain quality assurance and improvement – not only in seafood primary production but also at other stages of the chain. The reasons are that the SFCs' participations in primary production quality assurance are still limited due to their finances and managerial-technological constraints. In addition, all chain stakeholders including the SFCs have been incompletely integrated in order to solve quality and safety problems during primary production. As a result, there are limitations to enhancing the responsibility of the farmers and other relevant stakeholders to guarantee the quality of raw materials. At the company level, local government, fisheries industry, and support organizations fail to implement a proper HACCP audit and inspection system. Therefore, the NAFIQAVED must cooperate with local fisheries departments (Extension Centre, FRDP, and Fisheries Department) to improve shrimp quality during primary production. Activities that are required for cooperation are: guiding the culture techniques, training on how to maintain raw materials, providing quality control information concerning chemical use during culture procedures, and expanding the regulations and the decrees related to fishery quality and safety.

Furthermore, the survey revealed a functional organization with a top-down culture, a lack of market orientation, and difficulties with respect to chain collaboration.

7.2.3 The seafood supply chain quality management framework

Development of the SCQM framework aims to cover the seafood chain problems mentioned above subsection. The possibilities to improve the quality are different for the SFC part and for the primary production part. In primary production, there are many small hatcheries, farms and collectors/wholesale buyers. Here the support organizations (NAFIQAVED and VASEP) and local fisheries departments have to play a major role. Apart from that, there is the role of the SFCs in their supplier quality management and partnerships. The primary production part of the framework stresses the importance of broad support and of good horizontal and vertical collaboration. In the SFC part, the main actors in realizing improvement are the SFCs. The SFC part of the framework stresses the HACCP implementation.

7.2.4 Test results in two case studies

The framework was applied to two SFCs. Quality management in general and the HACCP system implementation in particular are tested in two SFCs in the MD. Test results are presented and discussed in Chapter 5. The focus was on testing HACCP implementation. This included tests on (1) the development and on-site verification of the flow diagram; (2) conducting a hazard analysis in the company (Principle 1); (3) determining Critical Control Points or CCPs (Principle 2); (4) establishing of critical limits for each CCP (Principle 3); (5) establishing a monitoring system for each CCP (Principle 4); (6) establishing a corrective action plan (Principle 5); (7) verification of the HACCP plan (Principle 6); and (8) establishing record-keeping and documentation (Principle 7). The test proved to be useful. Many quality gaps as well as chain deficiencies identified in this phase proved to form a sound basis for developing quality improvement. The following are main conclusions of the test results in companies A and B.

Although company A and B differ with respect to organizational mechanism (state-owned and private SFCs) and decision-making levels, they have the same techno-managerial problems regarding product quality and safety assurance during primary production. Both of these companies have not applied HACCP in the primary production yet, because they did not enough money and managerial capacities to implement HACCP in their chains.

At the company level, A and B have implemented the HACCP system albeit not sufficiently. For instance, quality assurance audit in general and HACCP audit in particular do no feature in the HACCP implementation procedure. In addition,

managerial improvement and encouragement of employee participation are limited due to top-down management. The organizational factor should be improved by a bottom-up change because in a bottom-up structure the initiatives for change come from the people in the organization and, they are supported by the lower and middle managers. Bottom-up change is essential to the SFCs' organizational innovation and is very useful in terms of adapting operations and technologies in order to change requirements of work. Empowerment, involvement and participation enable this change. An important condition for change is that the management is open to change. All of these issues link organizational behaviour to quality in the company. In distribution, company B is faced with transportation difficulties due to that fact that they are located far from the harbour, while company A deals with problems concerning storage time.

7.2.5 The SFC quality improvement process

In order to further improve seafood quality and safety at the SFCs, a quality improvement process is suggested. The process consists of nine steps. They are having top management commitment (Step 1); setting a company's quality performance goals (Step 2); implementing quality management in practice (Step 3); comparing implementation results with the company's goals and HACCP standards (Step 4); identifying quality gaps and deficiencies (Step 5); planning a quality improvement (Step 6); implementing the quality improvement plan (Step 7); checking the implementation results (Step 8); and analyzing the results (Step 9). Because time was limited, the nine steps were not tested completely. Instead, a meeting was organized for each of the two participating SFCs plus their supporting organizations. The identification of so-called company factors and chain factors proved to be very useful.

7.2.6 Chain quality improvement measures

Like the SFC quality improvement process, chain quality improvement measures are included in the improvement phase. Chain quality improvement measures are based partly on the SFC feedback on chain quality problems and on the improvement possibilities there. To obtain a systematic understanding of these problems and possibilities, an interview round among chain actors and experts was conducted. Interview results gave us possibilities for chain quality improvement. The most important suggestions concern (1) establishing larger hatcheries that will be able to gain capital to invest in modern technology and to develop adequate quality management in order to make it possible to apply for an HACCP program; and (2) establishing large culture farms/cooperatives that can easily receive centralized support from support organizations. Support activities include an input-output process, product inspection, techniques, capital, management, technology, and environmental protection.

7.3 Recommendations for further seafood quality improvement

This section contains a number of recommendations that are based on the test results and experiences with the shrimp supply chain during the research; they are however not direct research results. Recommendations for company A and B, managerial-technological interaction, management, and technology are presented below.

7.3.1 Recommendations for the test companies

7.3.1.1 In the case of company A

In order to achieve quality objectives, company A needs to consider the following.

- ***In the short term***

The company should follow the following four-step process:

- Step 1: Considering the status quo of the company, which can help the company understand where it stands and what it needs to implement an improvement plan.
- Step 2: Discovering the gaps and finding solutions to prepare the implementation of the improvement plan.
- Step 3: Changing the managerial method (if necessary) to ensure all employees will participate – focus especially on bottom-up change.
- Step 4: Implementing the improvement plan by using the PDCA cycle.

The implementation of this four-step process will help the company achieve its quality goals. However, the level of implementation achievement depends on the company's managerial and technological conditions, capital condition, and on the attitude of the people involved.

- ***In the long term***

The company should be equitized into a joint-stock company. This kind of company can obtain more capital to invest in all aspects that are related to quality improvement, such as investments in modern processing technologies and equipment, managerial changes, organizational changes. Besides, the company could invest in primary production to ensure the quality of raw material, or it could invest in farmers and provide a quality control. This would enhance the quality of the company's input materials. However, employee responsibility and awareness are very important during the implementation process in order to obtain quality objectives of the company.

7.3.1.2 In the case of company B

It is relatively easy for company B to implement the improvement plan. For a company with join-stock ownership, it can be easy to change quality-oriented management methods, to invest in modern processing technology and equipment, to invest in primary production, and to monitor the quality of raw material. The main issue is encouraging all employees who participate in quality management and increasing their responsibilities. To do so, the company should organize quality training and initiate good employee policies that are related to product quality assurance and improvement. These advantages would help the company to successfully implement the improvement plan. The company should also start implementing the improvement plan by going through the above-mentioned four-step process.

7.3.2 Recommendations at chain level

Solutions for further seafood quality improvement should combine technological aspects with attention for appropriate type of management. This should occur throughout the chain, from primary production to distribution. To do so, the industry support organizations should prioritize technology investment, especially in primary production. The industry has to invest in technology and management of the Extension Centre and FRDP. These latter organizations are very close to the farmers, so with these investments the farmers receive help quickly and effectively. Moreover, it is necessary to have a strict ban on behaviour that threatens seafood safety and quality, such as mixture injection, trade cheating, negative competition, use of forbidden chemicals in fisheries production, processing and storage, and to introduce suitable penalties. To this end, local market managers, the Fisheries Department, the Extension Centre and SFCs should increase the integrated observation and inspection of the buying-selling market for shrimp. At the same time, SFCs should not only apply HACCP within the company but they ought to expand it to the wholesale buyer and collector. Moreover, it is necessary to use effectively and efficiently modern technology and equipment that has been invested in by large SFCs, NAFIQAVED and FRDP. Furthermore, the HACCP program must be applied in both hatchery and farm and audited by the support organizations (VASEP, NAFIQAVED, and local departments). These issues should be discussed at VASEP meetings in which all SFCs and other stakeholders are involved.

7.3.3 Managerial recommendations

- *Leadership*

Most of the SFCs in the MD use top-down management. Bottom-up communication and management is essential if one wants to change the SFC organization. This bottom-up communication is also useful when adapting operations procedures and technology to the changing work requirements. An important condition for change is always change-oriented leadership. Bottom-up

management is necessary to gather employee feedback for quality improvement and to keep them involved. The opinions of employees therefore should be considered a useful source of information for quality improvement decisions. Middle managers and line managers have both responsibilities - following the higher managers' decisions and reflecting the employee feedback. Top managers should take into account managerial improvement and encourage employee participation.

- *Organizational behaviour and training*

The management of the company should ensure that there is interaction between management and technology in aiming for quality and safety to meet or exceed customer expectations. Therefore, the company has to understand the customer requirements concerning product quality, the company's situation, and investments needed in quality improvement. These requirements have to be communicated, and all levels of managers and employees at the company have to be trained, so that customers can be satisfied.

The following figure shows four managerial levels in the company: the first line managers (production group management), the second line managers (product line management), the middle managers (factory management), and the top managers (company management). Top and middle managers should be officially trained on quality and high managerial knowledge, because they are the ones that set up the company's quality goals and the overall control. Furthermore, top and middle managers are responsible for training quality control knowledge to (1) the first and second line managers, (2) all employees in the company, and (3) the shrimp wholesale buyers. The first and second line managers must be trained in quality and managerial knowledge, but also in relevant fisheries specializations. The workers should be trained by the top and middle managers, but also by the first line managers on the quality issues each group ought to implement. Also, managers of all levels need to be taught statistical knowledge and skills.

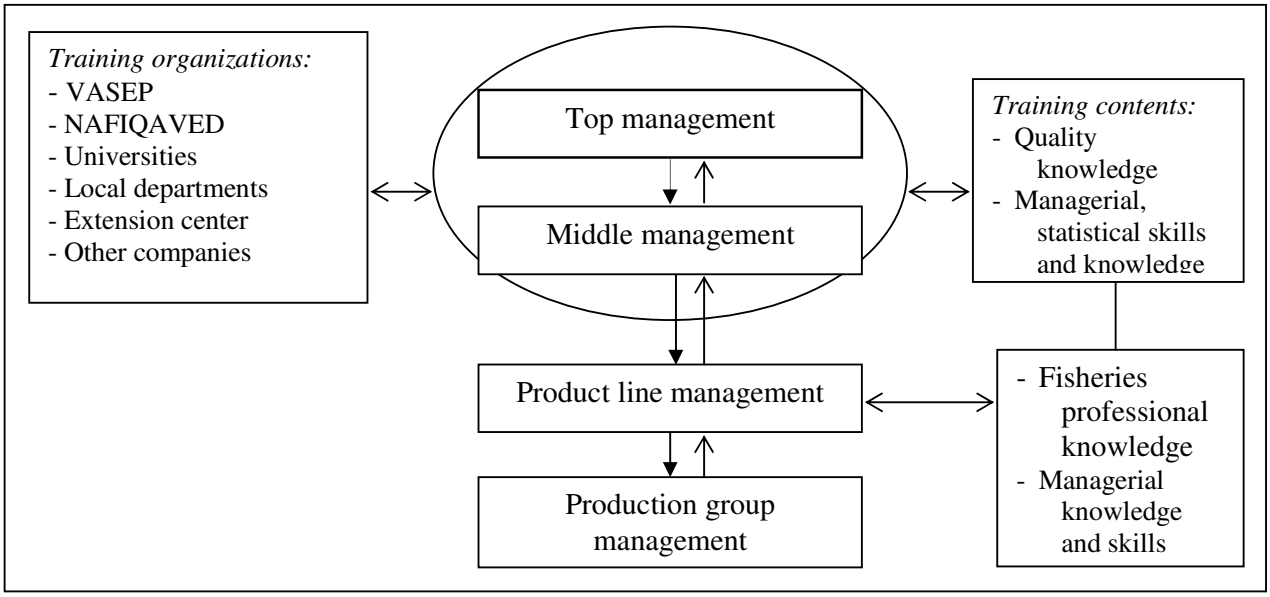


Figure 7.1 Managerial levels, knowledge and skills

7.3.4 Technological recommendations

Improvement of and investment in technology and equipment to ensure product quality and technical requirements are extremely important if one wants to prevent hazardous infections in the seafood supply chain. Therefore, together with aiming at hygienic manufacturing, each SFC should collaborate with other SFCs, the NAFIQAVED and the FRDP who have invested in modern technology and equipment for both quantitative and qualitative tests of all fishery hazards.

Furthermore, the following technologies have been widely applied in the EU and in developing countries such as Thailand. Application of these technologies will help SFCs to enhance quality improvement in order to meet the quality requirements of import markets as well as to be able to get more involved in international business. Thus, SFCs need to research and use:

- new identification systems and data handling procedures, and these must often be integrated into their quality management system and their HACCP system;
- a blend of short-term and long-term laboratory and field consumer trials and surveys. Research into consumer information, expectations and acceptance can show how different types of information will influence ratings for acceptance and future purchase intentions;
- some technologies for food quality assurance such as hurdle technology, osmotic treatment, and shrink-wrapping that are currently in use and are expanding to developing countries. Hurdle technology and osmotic

treatment are tools to obtain intermediate and end products of greater quality. Shrink-wrapping has been introduced as a suitable method for food quality and safety in value added seafood products;

- a quality index method and the definition of storage management and production planning procedures. The quality index method includes sensory tests on raw and cooked fish;
- time analysis of residues in seafood.

7.4 General situations of SFCs in the MD and the test companies at present (2006)

According to the information from the VASEP website, from some members of SFC staff who are studying for their Master's degree at Cantho University, and from several students' graduation theses in Cantho University, compared to 2003 SFCs in the MD in general and the test companies in particular now focus very much on product quality improvement within the companies and their chains. Many SFCs have been equitized and some large companies have been listed in the Vietnam stock market to gain more capital for their quality improvement activities.

Quality Control Departments of the SFCs enhance quality control at four levels of management, they transfer quality knowledge onto their employees and they encourage employees' feedback on product quality and safety by introducing bonus policies. In particular, company A was equitized into a stock company. So far, this type of ownership has lots of advantages; for example, (1) the company receives a large amount of share capital from its employees, which can be invested in modern technology as well as in quality improvement, (2) the company also achieves loyal employees on quality behaviour for the implementation of HACCP system as well as for the application of PDCA cycle strictly. Company B however invests its capital in the quality improvement of the HACCP implementation process and high quality materials. Together with a stricter management and more cooperation between local fisheries departments and support organizations, the quality and safety of seafood products of the SFCs in the MD in general and the test companies in particular increase as a result. It is a fact that the percentage of SFC seafood containers that is sent back from import markets decreases a lot.

7.5 Recommendations for further research

Shrimp quality improvement in the entire chain is very important for Vietnam's shrimp industry. The shrimp supply chain in the MD includes the primary production stage (hatcheries, farms, collectors, and wholesale buyers), the SFC

stage, and the distribution stage. The focus of the current research has been on the SFC stage, with an emphasis on the implementation of HACCP. Some attention has been paid to primary production.

Although the current situation of SFCs in the MD is showing progress with respect to ensuring seafood products in general and shrimp product quality and safety in particular, it is necessary to focus further research on primary production and export aspects.

As is mentioned in the study, SFCs play an important role in the supply chain. Therefore, further scientific research regarding seafood safety in primary production and export distribution needs to include the role of SFCs and support organizations as well.

The author strongly advises further research into the following topics/issues.

- Research on shrimp seed quality management and its impact on the quality of raw shrimp material and on final shrimp products.
- Research on shrimp quality and safety control at the collector/wholesale buyer stage.
- Research on the seafood market channel and the organization of seafood exports in Vietnam.

These research topics will be very useful for Vietnam's Fisheries Industry, the local governments, VASEP and NAFIQAVED, and for all chain stakeholders. They will help to improve shrimp quality and safety throughout the chain as well as help fisheries experts to direct further improvement of the seafood supply chain.

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Food Safety Standards

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Appendix 1 Form No: ……

QUESTIONNAIRE

FOR INTERVIEWING SEAFOOD COMPANIES IN THE MD

Research project title

Quality Management in Shrimp Supply Chain in the Mekong Delta, Vietnam

Interviewer: …….

Date: ……..

Dec. 2002

Appendix 1

QUESTIONNAIRE

FOR INTERVIEWING SEAFOOD COMPANIES IN THE MD

Good morning (!) I am a SEBA lecturer of Cantho University. I am studying quality management of seafood products in general and shrimp products in particular. The objective of the study aims to develop ***a feasible framework for improvement of quality assurance procedures with respect to the shrimp supply chain in the MD*** in order to improve shrimp quality that satisfies market standards and better serves customer needs today. If you do not mind, please tell me what has affected your shrimp product quality by answering the following questions. I ensure to keep secret all answered information of yours. *(Note: if any question makes you confused to answer, please see enclosed explanation, thank you!)*

A. General information of the company

1. *Personal information of interviewees:* (V1) **CODE**

	V1
1.1 Name: ……	1. ……
1.2 Age: ……	2. ……
1.3 Sex: 1. Male 2. Female	3. ……
1.4 Position: ……	4. ……
1.5 Educational level: ……	5. ……

2. *General information of the company*: (V2)

	V2
2.1 Name of company: ……	1. ……
2.2 Province: ……	2. ……
2.3 Business time (No. of years): ……	3. ……
2.4 Main export products:	V2.4
……	1. ……
……	2. ……
……	3. ……
……	4. ……
2.5 Main export markets:	V2.5
……	1. ……
……	2. ……
……	3. ……
……	4. ……
2.6 What made the company successful?	V2.6
……	1. ……
……	2. ……
……	3. ……
……	4. ……

2.7 How did the company control product quality in the past? V2.7a

a. Raw materials bought: (MC) %

(i)	from free farmers, wholesale buyers	(…….%)	1. …… ……..
(ii)	from stable farmers, wholesale buyers	(…….%)	2. …… ……..…
(iii)	from sources invested by the company	(…….%)	3. …… ……..…

b. Which methods or policies are applied to control the quality from the answer (a)? V2.7b

(i) …… 1. …….

(ii) …… 2. …….

(iii) …… 3. …….

2.8 Compared with the other seafood firms in the region, please circle a number for each situation of your seafood (SF) products (1. Worst in the region; 2. Below average; 3. Average; 4. Above average; 5. Best in the region).

V2.8

Aspects related to shrimp quality	1(A)	2(B)	3(C)	4(D)	5(E)
1. The performance of SF products	1	2	3	4	5
2. The conformity of SF products	1	2	3	4	5
3. The reliability of SF products	1	2	3	4	5
4. The diversification of SF products	1	2	3	4	5
5. The refused rate of SF products	1	2	3	4	5

2.9 Business result of your firm in 2001 compared with other seafood firms in the region:

1. Losing money badly V2.9 ……
2. Losing money slightly
3. Breaking even
4. Making some profits
5. Making high profits

2.10 Advantages in business operation (from 1 - weak to 5 - high):

V2.10

Advantage statement	1(A)	2(B)	3(C)	4(D)	5(E)
1. Financial satisfaction	1	2	3	4	5
2. Authorities' support	1	2	3	4	5
3. Stable raw materials	1	2	3	4	5
4. Management level	1	2	3	4	5
5. Processing technology	1	2	3	4	5
6. Quality knowledge of managers	1	2	3	4	5
7. Quality knowledge of employees	1	2	3	4	5
8. HACCP application	1	2	3	4	5
9. ISO, GMP, SSOP, or SQF applications	1	2	3	4	5

2.11 Disadvantages in business operation (from 1 - weak to 5 - high):

V2.11

Disadvantage statement	1(A)	2(B)	3(C)	4(D)	5(E)
1. Lack of capital	1	2	3	4	5
2. Lack of authorities' support	1	2	3	4	5
2. Lack of raw materials	1	2	3	4	5
4. Lack of management knowledge	1	2	3	4	5
5. Investment level of technology	1	2	3	4	5
6. Quality knowledge of managers	1	2	3	4	5
7. Business action	1	2	3	4	5
8. Independent level in business	1	2	3	4	5
9. Market information channel	1	2	3	4	5
10. Investment of improving quality	1	2	3	4	5

2.12 Please choose a number for each item of overall satisfaction level in your firm from 1 (extremely unsatisfied) to 5 (extremely satisfied). (SC)

V2.12

Item of satisfaction level	1(A)	2(B)	3(C)	4(D)	5(E)
1. Overall manager satisfaction	1	2	3	4	5
1. Employee satisfaction	1	2	3	4	5
2. Customer satisfaction	1	2	3	4	5

B. Company's shrimp product quality through the chain

1. Supplier's shrimp quality: **(V3)**

1.1 Generally, how good are shrimp materials (SM) from suppliers in terms of quality (SC)

1. Good 2. Average 3. Bad V3.1 ……

1.2 The reasons for that are V3.2

…… 1 ……..
…… 2 ……..
…… 3 ……..
…… 4 ……..

1.3 How does your firm measure the level of quality mentioned in question 1.1?

V3.3

…… 1 ……..
…… 2 ……..
…… 3 ……..
…… 4 ……..

1.4 How stable is your firm in the relation to suppliers? V3.4

…… 1 ……..
…… 2 ……..
…… 3 ……..
…… 4 ……..

1.5 Does the firm compete with other SFCs in the purchase of shrimp materials?

1. Yes 2. No V3.5 ……

1.6 If yes, which aspects and level of competition?
(please circle the number for each type of competition):

Competition aspect	1. High	2. Average	3. Low
1. Competition on source of supplying SM	1	2	3
2. Competition on price	1	2	3
3. Competition on shrimp species (size and grading)	1	2	3

V3.6

2. Manufacturing process: (V4)

2.1 According to you, which factors in the following list affect shrimp quality in your company actually? (MC)

V4.1

1. Quality of shrimp material from the farmers 1 …….
2. Purchasing process 2 …….
3. Storage process 3 …….
4. Transportation process 4 …….
5. Processing technology 5 …….
6. Processing techniques 6 …….
7. Others: (please specify)
   …….. 7.1 ……
   …….. 7.2 ……
   …….. 7.3 ……

2.2. If the shrimp quality problem arose from the purchasing process, which reasons affected finished shrimp quality in your company actually? (MC)

V4.2

1. Purchased shrimp quality 1 …….
2. Storage equipment when buying shrimp material 2 …….
3. Storage time before transporting to the company 3 …….
4. Transportation means 4 …….
5. Transportation time to the company 5 …….
6. Skills and responsibility of buyers 6 …….
7. Others: (please specify)
   …….. 7.1 ……
   …….. 7.2 ……
   …….. 7.3…….

2.3. If the quality problem arose from the processing stage, which reasons affected output of finished shrimp quality in your company actually? (MC)

	V4.3
Shrimp quality before processing	1 …….
1. Processing time	2 …….
2. Processing technology	3 …….
3. Processing techniques	4 …….
4. Inventory time of finished products	5 …….
5. Storage means	6 …….
6. Others: (please specify)	
……..	7.1 ……
……..	7.2 ……
……..	7.3 ……

3. Distribution process

3.1 If the quality problem arose from the distribution stage, which reasons affected output of shrimp quality in your company actually (MC)?

	V5
1. Quality of finished shrimp products	1 …….
2. Kinds of finished shrimp products	2 …….
3. Customer behaviour	3 …….
4. Inventory time of finished products	4 …….
5. Transportation means	5 …….
6. Transportation time	6 …….
7. Storage equipment	7 …….
8. Customer's buying contracts in trouble	8 …….
9. Others: (please specify)	
……..	9.1 …….
……..	9.2 …….
……..	9.3 …….

4. Which factors determine the quality of shrimp products in each process?

	V6
4.1 In purchasing process:	V6.1
. ……..	1 …….
. ……..	2 …….
..……..	3 …….
4.2 In manufacturing process:	V6.2
. ……..	1 …….
. ……..	2 …….
..……..	3 …….
4.3 In distribution process:	V6.3
. ……..	1 …….
. ……..	2 …….
..……..	3 …….

C. The current situation of company's quality management: (V7)

Please circle the number for each statement applied to the company using a 5-point scale *(gradual level of agreement: 1. Strong disagree...and 5. Strongly agree.)* (SC)

1. Leadership: V7.1

(i)

Statement	Strongly Disagree (A)	Disagree (B)	Neutral (C)	Agree (D)	Strongly Agree (E)
1. Top management actively participates in QM* activities	1	2	3	4	5
2. Top management learns quality-related concepts and skills	1	2	3	4	5
3. Top management strongly encourages employee involvement in QM activities	1	2	3	4	5
4. Top management empowers employees to solve quality problems	1	2	3	4	5
5. Top management arranges adequate resources for employee education and training	1	2	3	4	5
6. Top management discusses quality-related issues in top management meetings	1	2	3	4	5
7. Top management focuses on product quality rather than yields	1	2	3	4	5
8. Top management pursues long-term business success	1	2	3	4	5

**QM: Quality Management*

(ii) Reasons for choosing the number 1, or 2, or 3 of each statement in (i)

V7.2

Statement	Reasons
1. Top management actively participates in QM* activities	a1. …….. …… a2. …….. ……
2. Top management learns quality-related concepts and skills	b1. …….. …… b2. …….. ……
3. Top management strongly encourages employee involvement in QM activities	c1. …….. …… c2. …….. ……
4. Top management empowers employee to solve quality problems	d1. …….. …… d2. …….. ……
5. Top management arrange adequate resource for employee education and training	e1. …….. …… e2. …….. ……

6. Top management discusses quality-related issues in top management meetings	f1. …….. …… f2. …….. ……
7. Top management focuses on product quality rather than yields	g1. …….. …… g2. …….. ……
8. Top management pursues long-term business success	h1. …….. …… h2. …….. ……

2. Supplier quality management: (SC) **(V8)**

(i)

V8.1

Statement	Strongly Disagree (A)	Disagree (B)	Neutral (C)	Agree (D)	Strongly Agree (E)
1. Your firm has established long-term cooperative relations with suppliers	1	2	3	4	5
2. Your firm regards shrimp quality as the most important factor in selecting suppliers	1	2	3	4	5
3. Your firm always participates in supplier activities related to shrimp quality	1	2	3	4	5
4. Your firm always gives feedback on the production of supplier's shrimp material	1	2	3	4	5
5. Your firm has detailed information about supplier performance	1	2	3	4	5
6. Your firm regularly conducts supplier quality audit	1	2	3	4	5

(ii) Reasons for choosing the number 1, or 2, or 3 of each statement in (i)

V8.2

Statement	Reasons
1. Your firm has established long-term cooperative relations with suppliers	a1. …….. …… a2. …….. ……
2. Your firm regards shrimp quality as the most important factor in selecting suppliers	b1. …….. …… b2. …….. ……
3. Your firm always participates in supplier activities related to shrimp quality	c1. …….. …… c2. …….. ……
4. Your firm always gives feedback on the production of supplier's shrimp material	d1. …….. …… d2. …….. ……
5. Your firm has detailed information about supplier performance	e1. …….. …… e2. …….. ……
6. Your firm regularly conducts supplier quality audit	f1. …….. …… f2. …….. ……

3. Process control and improvement: (SC) **(V9)**

(i) V9.1

Statement	Strongly Disagree (A)	Disagree (B)	Neutral (C)	Agree (D)	Strongly Agree (E)
1. Your firm is kept neat and clean at all times	1	2	3	4	5
2. Process capability can meet production requirements	1	2	3	4	5
3. Production equipment is well maintained to maintenance plan	1	2	3	4	5
4. Your firm implements various inspections effectively (e.g., process and final products)	1	2	3	4	5

(ii) Reasons for choosing the number 1, or 2, or 3 of each statement in (i)

V9.2

Statement	Reasons
1. Your firm is kept neat and clean at all times	a1. …….. a2. ……..
2. Process capability can meet production requirements	b1. …….. b2. ……..
3. Production equipment is well maintained to maintenance plan	c1. …….. c2. ……..
4. Your firm implements various inspections effectively (e.g., process and final products)	d1. …….. d2. ……..

4. Quality system improvement: (SC) (V10)

(i) V10.1

Statement	Strongly Disagree (A)	Disagree (B)	Neutral (C)	Agree (D)	Strongly Agree (E)
1. The quality system in your firm is continuously being improved	1	2	3	4	5
2. Your firm uses ISO 9000 as a guideline for establishing your quality system	1	2	3	4	5
3. Your firm has a clear quality manual	1	2	3	4	5
4. Your firm has a clear procedure documents	1	2	3	4	5
5. Your firm has a clear working instruction	1	2	3	4	5

(ii) Reasons for choosing the number 1, or 2, or 3 of each statement in (i)

V10.2

Statement	Reasons
1. The quality system in your firm is continuously being improved	a1. …….. a2. ……...
2. Your firm uses ISO 9000 as a guideline for establishing your quality system	b1. …….. b2. ……...
3. Your firm has a clear quality manual	c1. …….. c2. ……...
4. Your firm has a clear procedure documents	d1. …….. d2. ……..
5. Your firm has a clear working instruction	e1. …….. e2. ……..

5. Employee participation: (SC) **(V11)**

(i) V11.1

Statement	Strongly Disagree (A)	Disagree (B)	Neutral (C)	Agree (D)	Strongly Agree (E)
1. Your firm has cross-functional teams	1	2	3	4	5
2. Your firm has several QC* circles (within one function)	1	2	3	4	5
3. Employees are actively involved in quality-related activities	1	2	3	4	5
4. Your firm implements suggestion activities extensively	1	2	3	4	5
5. Most employees' suggestions are implemented after an evaluation	1	2	3	4	5
6. Employees are very committed to the success of your firm	1	2	3	4	5
7. Employees are encouraged to fix problems they find	1	2	3	4	5
8. Reporting work problems is encouraged in your firm	1	2	3	4	5

**QC: Quality Control*

(ii) Reasons for choosing the number 1, or 2, or 3 of each statement in (i)

V11.2

Statement	Reasons
1. Your firm has cross-functional teams	a1. …….. a2. ……..
2. Your firm has several QC* circles (within one function)	b1. …….. b2. ……..
3. Employees are actively involved in quality-related activities	c1. …….. c2. ……..
4. Your firm implements suggestion activities extensively	d1. …….. d2. ……..
5. Most employees' suggestions are implemented after an evaluation	e1. …….. e2. ……..
6. Employees are very committed to the success of your firm	f1. …….. f2. ……..
7. Employees are encouraged to fix problems they find	g1. …….. g2. ……..
8. Reporting work problems is encouraged in your firm	h1. …….. h2. ……..

6. Education and training: (SC) **(V12)**

(i) V12.1

Statement	Strongly Disagree (A)	Disagree (B)	Neutral (C)	Agree (D)	Strongly Agree (E)
1. Employees are encouraged to accept education and training in your firm	1	2	3	4	5
2. Resources are available for employee education and training in your firm	1	2	3	4	5
3. Most employees in your firm are trained on how to use quality management tools	1	2	3	4	5
4. Quality awareness education is given to employees	1	2	3	4	5
5. Specific work-skills training is given to all employees	1	2	3	4	5
6. Employees are regarded as valuable, long-term resources worthy of receiving education and training throughout their career	1	2	3	4	5

(ii) Reasons for choosing the number 1, or 2, or 3 of each statement in (i)

V12.2

Statement	Reasons
1. Employees are encouraged to accept education and training in your firm	a1. …….. a2. ……..
2. Resources are available for employee education and training in your firm	b1. …….. b2. ……..
3. Most employees in your firm are trained on how to use quality management tools	c1. …….. c2. ……..
4. Quality awareness education is given to employees	d1. …….. d2. ……..
5. Specific work-skills training is given to all employees	e1. …….. e2. ……..
6. Employees are regarded as valuable, long-term resources worthy of receiving education and training throughout their career	f1. …….. f2. ……..

7. Consumer focus: (SC) **(V13)**

V13.1

(i)

Statement	Strongly Disagree (A)	Disagree (B)	Neutral (C)	Agree (D)	Strongly Agree (E)
1. Your firm has extensive complaint information from customers	1	2	3	4	5
2. Quality-related customers complaints are treated with top priority	1	2	3	4	5
3. Your firm conducts a customer satisfaction survey every year	1	2	3	4	5
4. Your firm always conducts market research in order to collect suggestions for improving your products	1	2	3	4	5
5. Your firm provides warranty on your sold products to customers	1	2	3	4	5
6. Your firm has been customer focused for a long time	1	2	3	4	5

(ii) Reasons for choosing the number 1, or 2, or 3 of each statement in (i)

V13.2

Statement	Reasons
1. Your firm has extensive complaint information from customers	a1. …….. a2. ……..
2. Quality-related customers complaints are treated with top priority	b1. …….. b2. ……..
3. Your firm conducts a customer satisfaction survey every year	c1. …….. c2. ……..
4. Your firm always conducts market research in order to collect suggestions for improving your products	d1. …….. d2. ……..
5. Your firm provides warranty on your sold products to customers	e1. …….. e2. ……..
6. Your firm has been customer focused for a long time	f1. …….. f2. ……..

D. HACCP procedure and implementation at the company

4.1 Assembling of an HACCP team (V14)

(i) Does your firm establish an HACCP team? 1. Yes 2. No V14a……

(ii) If yes, who in the following list are included the team? V14b……

1. A quality assurance/quality control specialist 1. ……...
2. A production specialist 2. ……...
3. An engineer 3. ……...
4. Other specialists: buyers, operators, packaging experts, distribution experts, hygiene manager 4. ……...
5. A member of the management. 5. ……...

4.2 Description of the product and its distribution (V15)

(i) Has the team ever described the product and its distribution?

1. Yes 2. No V15a……

(ii) If yes, which of the following aspects are described by the team? V15b

1. Composition and physical features of final product 1. ……...
2. Process information (production methods used) 2. ……...
3. Method of packaging 3. ……...
4. Required shelf life 4. ……...
5. Storage and distribution conditions along the chain 5. ……...
6. Legislative product requirements 6. ……...
7. Instructions for use and storage by consumers 7. ……...

4.3 Does the firm identify intended use and consumers? 1. Yes 2. No **V16**…

4.4 Development of process flow diagrams (V17)

(i) Does the firm develop process flow diagrams? 1. Yes 2. No V17a……

(ii) If yes, which of the following typical data are included? V17b

1. All raw materials/ingredients and packaging used 1. ……...
2. Time/temperature history of the chain 2. ……...
3. Process conditions 3. ……...
4. Storage and distribution conditions 4. ……...
5. Product loops for recycling or rework 5. ……...
6. Routes of potential cross-contamination 6. ……...
7. High/low risk area segregation 7. ……...
8. Overview of floors and layout of equipment 8. ……...
9. Features of equipment design 9. ……...
10. Efficacy of cleaning and disinfection procedures 10. ……
11. Personal hygiene practices 11……...
12. Consumer-use instructions 12……...

4.5 Does the firm inspect the process and verify the flow diagram?

1. Yes 2. No **V18**…….

4.6 Assessing the hazards:

Which stages and level (from 1-low obtainment to 5- high obtainment) in the chain has your firm obtained in the hazards control?

V19

The stages in the chain	1(A)	2(B)	3(C)	4(D)	5(E)
1. *Purchasing raw materials:*					
• hygiene of equipment	1	2	3	4	5
• temperature	1	2	3	4	5
• ice hygiene	1	2	3	4	5
2. *Shrimp material receiving and handling:*					
• Source of shrimp materials	1	2	3	4	5
• hygiene of equipment and devices	1	2	3	4	5
• temperature	1	2	3	4	5
• maintaining time	1	2	3	4	5
• ice hygiene	1	2	3	4	5

3. *Shrimp processing:*					
• in preliminary process	1	2	3	4	5
• in classification process	1	2	3	4	5
• in washing process	1	2	3	4	5
• in scale and frame process	1	2	3	4	5
• in shrimp freeze	1	2	3	4	5
• in ice-plated process	1	2	3	4	5
• in metal check process	1	2	3	4	5
4. *Packaging:*					
• hygiene and no smell of bag and box	1	2	3	4	5
5. *Storage:*					
• hygiene and no smell of warehouse	1	2	3	4	5
• maintaining temperature and time	1	2	3	4	5
• method of allocation	1	2	3	4	5
6. *Distribution:*					
• hygiene of equipment and devices	1	2	3	4	5
• temperature	1	2	3	4	5
• transportation time	1	2	3	4	5
• distribution forms	1	2	3	4	5
• perceptible, biological, physical and chemical indicators	1	2	3	4	5

4.7 Ranking of hazards' risk characteristics

(i) What microbiological hazards did happen in your company? **V20**

…… 1. …….

…… 2. …….

…… 3. …….

…… 4. …….

(ii) What chemical hazards did happen in your company? **V21**

…… 1. …….

…… 2. …….

…… 3. …….

…… 4. …….

(iii) What physical hazards did happen in your company? **V22**

…… 1. …….

…… 2. …….

…… 3. …….

…… 4. …….

(iv) Please rank the hazards (please tick in the cell from 1-high frequency to 5-low frequency) in the chain.

V23

The hazards occurred in the chain	1(A)	2(B)	3(C)	4(D)	5(E)
(i) microbiological hazards					
(ii) chemical hazards					
(iii) physical hazards					

4.8 Determination of Critical Control Points (CCP)

Where are in the following stages that your company determined CCPs? (please tick in the cell)

V24

Stages	CCPs
1. Purchase of raw materials	
2. Shrimp material receiving and handling	
3. Shrimp processing	
4. Packaging	
5. Storage	
6. Distribution	

4.9 Establishing Critical limits for CCPs

For which hazards did your company establish Critical limits for CCPs (please circle the number)

V25

1. Microbiological limits — 1. ……...
2. Chemical limits — 2. ……...
3. Physical limits — 3. ……...

4.10 Establishing procedure to monitor critical limits

(i) What do you monitor? **V26**

…… 1. …….

…… 2. …….

…… 3. …….

…… 4. …….

(ii) Why do you monitor? **V27**

…… 1. …….

…… 2. …….

…… 3. …….

…… 4. …….

(iii) How do you monitor? **V28**

…… 1. …….

…… 2. …….

…… 3. …….

…… 4. …….

(iv) Where do you monitor? **V29**

…… 1. …….

…… 2. …….

…… 3. …….

…… 4. …….

(v) Who monitors? **V30**

…… 1. …….

…… 2. …….

…… 3. …….

…… 4. …….

(vi) When do you monitor? **V31**

…… 1. …….

…… 2. …….

…… 3. …….

…… 4. …….

4.11 Establishing corrective action

(i) Did you use the results of monitoring to adjust the process in order to maintain control?

V32

1. Yes 2. No V32a. …….

- If yes, how many percentage in adjustment …… % V32b. …….

(ii) Did you deal with non-compliance product if control is lost **(V33)**

1. Yes 2. No V33a. …….

- If yes, how many percentage in adjustment …… % V33b. …….

(iii) Did you correct the cause of non-compliance **(V34)**

1. Yes 2. No V34a. …….

- If yes, how many percentage in adjustment …… % V34b. …….

(iv) Did you maintain records of the corrective actions which have occurred. **(V35)**

1. Yes 2. No V35a. …….

- If yes, how many percentage in adjustment …… % V35b. …….

4.12 Establishing effective recordkeeping systems

Which of the following records did your company establish? (please circle the number)

	V36
1. CCP records	1. …….....
2. Critical limit records	2. …….....
3. Records associated with deviations	3. …….....
4. Records and verification	4. …….....
5. Records review and retention	5. …….....
6. Regulatory access	6. …….....

4.13 Establishing procedures for verification that HACCP system is working correctly

Which of the following procedures did your company establish? (please circle the number)

	V37
1. Prevention	1. …….....
2. Team approach	2. …….....
3. Essential elements	3. …….....
4. CCP verification	4. …….....
5. Verification vs. monitoring	5. …….....
6. HACCP program verification	6. …….....
6.1 Receiving and storage	6.1. ……..…
6.2 Processing	6.2. ……..…
6.3 Processing equipment	6.3. ……..…
6.4 Cleaning and sanitizing	6.4. ……..…
6.5 Control devices	6.5. ……..…
6.6 Packaging materials	6.6. ……..…
7. Finishing product testing	7. …….....
8. Records	8. …….....
9. Written report	9. …….....

E. Other relevant quality standards (ISO, SQF, GMP and SSOP)

Along with HACCP, any standard is your firm following? And implemented level? (from 1- low implemented to 5-high implemented).

V38

Quality standards	1(A)	2(B)	3(C)	4(D)	5(E)
1. GMP					
2. SSOP					
3. TQM					
4. ISO					
5. SQF					

Thank you for your business.
Good success to your company!

Appendix 2

Coding For Analysing Qualitative Variables

Variables	Variables
V2.4: Products 1. Shrimp 2. Fish 3. Others (Mollusc, cuttle fish) **V2.5: Export markets** 1. Japan 2. The US 3. Korea 4. EU 5. Large companies in Vietnam 6. Others	**V2.6: Factors of SFCs' success** 1. Quality and reputation 2. Low cost 3. Good management 4. Man 5. Processing technology 6. Customer satisfaction 7. Stable raw materials **V2.7b: How to keep suppliers** 1. Fixed agencies, farmers, wholesale buyers and collectors 2. Perception 3. Company's control 4. Supplier's commitment
V3.2: Reasons to assess shrimp quality - *Reasons for good quality* 1. Correspond to Vietnam's quality 2. In accordance with the customer's requirements 3. Spot purchase 4. Good source of raw materials - *Reasons for average quality* 1. Far form raw material source 2. Raw materials from offshore 3. uncontrolled source of the materials 4. Perception 5. Low quality	**V3.3: How to measure the quality** 1. Perception 2. Materials without extraneous matter 3. Good natural source 4. Auditing 5. Consumer's opinions 6. Good management of material source **V3.4: How to keep the suppliers** 1. Price support 2. Providing market information 3. Several contracts of customers 4. Period Auditing 5. Quick payment 6. Reputation 7. Local buying net
V4.1: Others (7) 1. Service quality at the port	**V4.3: Others (7)** 1. Management of production and

2. Service of shipment by sea **V4.2: Others (7)** 1. Techniques of materials in salt and freeze 2. Management	processing 2. Preservation conditions when transporting
V6.1: Factors affected in purchasing process 1. Quality of material shrimp 2. Company's quality point of view 3. Maintenance means 4. Maintenance time 5. Techniques of materials in salt and freeze 6. Shrimp purchasing skills **V6.2: Factors affected in processing process** 1. Worker's skills 2. Worker's consciousness 3. Management level of leaders 4. Quality of material shrimp 5. Processing techniques 6. Inventory **V26: What to monitor?** 1. Shrimp material temperature 2. Sulfite test 3. Shrimp materials 4. Processing chain **V27: Why to monitor?** 1. The hazards occurred often 2. Quality improvement 3. Prevention **V28: How to monitor?** 1. Period audit 2. Continuous audit 3. Frequent audit 4. Using machine 5. Perception **V29: Where to monitor?** 1. Receiving the materials 2. Metal check 3. Shrimp processing 4. Packaging	**V6.2: Factors affected in distribution process** 1. Transportation time 2. Inventory time 3. Quality of finished shrimp 4. Customer's buying contract in trouble 5. Maintenance temperature **V20: Microbiological hazards** 1. E.Coli 2. Salmonella 3. Staphycocours anreus 4. Coliform **V21: Chemical hazards** 1. Sulfite 2. Anti-biotic 3. Insecticide 4. Phosphor **V22: Physical hazards** 1. Metal 2. Smell and colours 3. Others **V30: Who monitor?** 1. Quality controller 2. Responsible person 3. Member of HACCP team **V31: When to monitor?** 1. At the beginning of the shift 2. Each block 3. Period time 4. Frequency

Appendix 3

List of the Interviewed SFCs in the MD

STT	Province	Name of the SFCs	Director & address
1	Long An	1. Long An Aquatic import-export company (LASIHCO)	Nguyen Phan Dau, 31 Nguyen Thi Bay street, ward 6, Tan An town. Tel. 072.826663/826263 Fax. 072.826411
2	Tien Giang	2. Tien Giang SEAPRODUCT company	Nguyen Huu Thuong, Tan My Chanh Village, My Tho city, Tel. 073.850020/850021 Fax. 073.850024
3	Ben Tre	3. Ben Tre frozen aquaproduct export company (AQUATEX BENTRE) 4. Frozen Factory 84	Dang Kiet Tuong, Quarter 9, Tan Thach precinct, Chau Thanh Dist. Tel. 075.860265/860513 Fax. 075.860346 Thai Thanh Hai, 457C – 885 str., ward 8, Bentre town. Tel.075.822708 Fax. 824374
4	Tra Vinh	5. Cuu Long SEAPRODUCTS company 6. Duyen Hai seafood factory	Nguyen Van Bang, 36 Bach Dang str. Precinct 4, Tra Vinh Town. Tel. 074.852465 Fax. 074.852078 Email. ctythuysancuulong@hcm.vnn.vn Nguyen Chi Thao, Duyen Hai dis., Tra Vinh Tel. 074.836379 Fax. 074.836379
5	Vénh Long	7. Vinh Long seaproduct import export company	Nguyen van Khuc, 5 April 30 str., Vinh Long town. Tel. 070.823618 fax. 070.823822
6	Dong Thap	8. Vinh Hoan Co., LTD	Truong Thi Le Khanh, National road 30, precinct 10, Cao lanh Town Tel. 067.891663/891166 Fax. 067.891062
7	An Giang	9. An Giang fisheries import and export company (AGIFISH CO)	Ngo Phuoc Hau. 1234 Tran Hung Dao str., Binh Duc Ward, Long Xuyen City. Tel.076.857724/852368 Fax. 076.852202 Email. agifishagg@hcm.vnn.vn
8	Kien Giang	10. Kien Giang seaproduct import & export company (KISIMEX)	Pham Hong Thien, 39 Dinh Tien Hoang str., Rach Gia Town Tel. 077.862104/866719/872707 Fax. 077.862677 Email. kisimex@hcm.vnn.vn

9	CanTho	11. CAFATEX Viet Nam	Nguyen Van Kich, km2081 – National Road No.1, Chau Thanh str. Tel. 071.847979/846737 Fax. 071.846728 Email. mkcafatex@hcm.vnn.vn Web site: www.cafatex.com.vn
		12. Can Tho Agricultural and Animal Products imex company (CATACO)	Nguyen Van Phuoc, 2 Ngo Huu Hanh str. Cantho City. Tel. 071.821455 Fax. 071.820285 Email. xncatacocantho@hcm.vnn.vn
		13. PATAYA food industry (Viet Nam) LTD.	Suthee Thirakittipong, Lot 44, Tra Noc Industrial Zone, Cantho city Tel. 071.842382 Fax. 071.842380 Email. ptivietnam@hcm.vnn.vn
		14. Seafood 404 Company	Nguyen Hong Quan, Le Hong Phong road, Binh Thuy precinct, Can Tho city. Tel. 071.841083/841228 Fax. 071.841071
		15. Nam Hai foodstuffs export CO. LTD.	Nguyen Huu Thanh, Block 14, Tra Noc Industry Zone, Can Tho city Tel. 071.842040 fax. 071.842279
		16. Mekong Seafood Stock Company	Luong Hoang Manh, Block 24, Tra Noc Industry Zone, Can Tho city Tel. 071.841294 fax. 071.841192
10	Soc Trang	17. Kim Anh CO., LTD.	Do Ngoc Quy, 49 National road 1, Quarter 2, Soc Trang province Tel. 079.822682/820382 Fax. 822762 Email. kimanhco@bdvn.vnd.net
		18. Soc Trang Aquatic product and general import – export company (STAPIMEX)	Nguyen Thanh Khiet, 119 National Road 1A, precinct 7, Soc Trang Town. Tel. 079.822164 Fax.079.821801 Email. stapimex@hcm.vnn.vn Website: www.stapimaex.com.vn
		19. Soc Trang Foodstuffs import – export company (FIMEX VN)	Ho Quoc Luc, Km 2132, National Road 1A, Soc Trang Province Tel. 079.822203/822223/828188/825280 Fax. 079.822122/825665 Email. fimexvn@hcm.vnn.vn
		20. Phuong Nam CO., LTD.	Lam Ngoc Khuan, km 2127 National Road 1A, Ward 7, Soc Trang Town Tel. 079.611678/611567 fax. 079.824233 Email. phuongnams@hcm.vnn.vn
11	Bac Lieu	21. Ho Phong sea-products import and export company	Tan Minh Hen, Ho Phong Small Town, Gia Rai dist. Tel. 0781.850347/850316 Fax. 850814 Email. hosimexco@hcm.vnn.vn

		22. Nissui Girimex company (NIGICO)	Seiji Ueki, National Road 1A, Ho Phong, Gia Rai, Bac Lieu province Tel. 0781.851160 Fax. 0781.850864 Email. nigico@hcm.fpt.vn
		23. Vinh Loi Import Export Company	Huynh Ngoc Tua, Cai Tram B Ward, Hoa Binh Town, Vinh Loi Dist. Tel. 0781.880348 Fax. 0781.880169
		24. Gia Rai General Import Export Company (GIRIMEX)	Nguyen Van Dua, National Road 1A, Ho Phong Town, Giarai Dis. Bac Lieu. Tel. 0781.851571 fax. 0781.850113
12	Ca Mau	25. CAIDOIVAM seafood import – export company (CADOVIMEX)	Vo Thanh Tien, Cai Doi Vam town, Cai Nuoc Dist. Ca Mau Province Tel. 0780.889054/831346 Fax. 889067
		26. Ca Mau Frozen Seafood Processing Import – Export Corporation (CAMIMEX)	Tran Quang Chieu, 133 Cao Thang road, Ward 2, Precinct 8, Ca Mau City Tel. 0780.836257 Fax. 0780.832297 Email. Camimex@hcm.vnn.vn Website: www.camimex.com
		27. Minh Hai export frozen seafood processing Joint – stock Company (JOSTOCO)	Huynh Huu Khuong, 9, ward 2, precinct 8, Ca Mau City Tel. 0780.831134 Fax. 0780.836921 Email. jostoco@hcm.vnn.vn
		28. Minh Hai seaproducts import and export corporation	Bui Nguyen Khanh, 1 block B, An Duong Vuong, precinct 7, Ca Mau city. Tel. 0780.831615/831230 Fax. 831861 Email. xnk mh@hcm.vnn.vn
		29. Minh Phu seafood PTE	Le Van Quang, Industrial Zone Ward 8, Ca Mau City Tel. 0780.838262 Fax. 0780.833119 Email. Minhphu@hcm.vnn.vn
		30. Phu Cuong CO. LTD.	Nguyen Viet Cuong, 454, Ly Thuong Kiet str., Ward 6, Ca Mau city Tel. 0780.835059/847422 Fax. 835334 Email. phucuongcm@hcm.vnn.vn
		31. Quoc Viet seaproducts processing trading and import – export CO., LTD.	Ngo Van Nga, 444, Ly Thuong Kiet str., precinct 6, Ca Mau city. Tel. 0780.830561/826011 Fax. 832021 Email. quocvietcm@hcm.vnn.vn
		32. Tan Thanh export products processing enterprise (AGRIMECO CA MAU)	Huynh Van Vung, 969 Ly Thuong Kiet str., precinct 6, Ca mau city. Tel. 0780.839058/837072 Fax. 835325 Email. xnk.nstp@hcm.vnn.vn

Appendix 4

List of Interviewees in The Research

STT	PROVINCE	NAME OF THE SFCs	INTERVIEWEE
1	Long An	33. Long An Aquatic import-export company (LASIHCO)	Nguyen Phan Dau, director Mobile. 0903.828955
2	Tien Giang	34. Tien Giang SEAPRODUCT company	Vo The Huy, Head of Business Office Mobile. 0903.650564
3	Ben Tre	35. Ben Tre frozen aquaproduct export company (AQUATEX BENTRE) 36. Frozen Factory 84	Dang Kiet Tuong, director Mobile. 0913.965357 Thai Thanh Hai, director Tel.075.822708 Fax. 824374
4	Tra Vinh	37. Cuu Long SEAPRODUCTS company 38. Duyen hai seafood factory	Nguyen Dieu Hung, Vice director Mobile. 0903732153 Nguyen Chi Thao, director Tel. 074.836379
5	Vinh Long	39. Vinh Long seaproduct import export company (IMEX Cuu Long)	Huynh Khanh Chau, Head of Planning Office Tel. 070.831139
6	Dong Thap	40. Vinh Hoan Co., LTD	Huynh Duc Trung, Vice director Tel. 067.891663
7	An Giang	41. An Giang fisheries import and export company (AGIFISH CO)	Nguyen Thi Hoang Yen, director of factory 7 Mobile. 0913.971266
8	Kien Giang	42. Kien Giang seaproduct import & export company (KISIMEX)	Nguyen Thanh Quoc, Vice director Mobile. 0913.740237
	CanTho	43. CAFATEX Viet Nam 44. Can Tho Agricultural and Animal Products imex company (CATACO) 45. PATAYA food industry (Viet Nam) LTD.	Nguyen Chien Thang, Head of Business Office Tel. 071.821455 Luong Thai Thanh, Head of Planning Office Tel. 071.820069 Le Van Diep, Head of Technical Office Mobile. 0903.752981

		46. Seafood 404 Company	Le Thi Hai Lan, Head of Technical Office Mobile. 0918.207917
		47. Nam Hai foodstuffs export CO. LTD.	Nguyen Huu Thanh, director Tel. O71. 842475
		48. Mekong Seafood Stock Company	Nguyen Van Dung, Head of Planning Office Mobile. 0918.026359
10	Soc Trang	49. Kim Anh CO., LTD.	Do Ngoc Quy, director Mobile. 0913.890053
		50. Soc Trang Aquatic product and general import – export company (STAPIMEX)	Nguyen Van Pham, Vice director Mobile. 0913.983308
		51. Soc Trang Foodstuffs import – export company (FIMEX VN)	Ho Quoc Luc, director Mobile. 0913.890122
		52. Phuong Nam CO., LTD.	Nguyen Van Thuan, Vice director Mobile. 0913.983250
11	Bac Lieu	53. Ho Phong sea-products import and export company	Nguyen Van Cuong, Vice director Tel. 0781.850347
		54. Nissui Girimex company (NIGICO)	Le Viet Anh, Vice director Mobile. 0913.991026
		55. Vinh Loi Import Export Company	Nguyen Van Can, Vice director Mobile. 0913.892109
		56. Gia Rai General Import Export Company (GIRIMEX)	Le Minh Khai, Vice director Mobile. 0913.694617
12	Ca Mau	57. CAIDOIVAM seafood import – export company (CADOVIMEX)	Nguyen Van Chan, Head of liaison Office Tel. 0780.831346
		58. Ca Mau Frozen Seafood Processing Import – Export Corporation (CAMIMEX)	Nguyen Van Phong, Head of Quality Management Office Mobile. 0903.920861
		59. Minh Hai export frozen seafood processing Joint – stock Company (JOSTOCO)	Nguyen Van Ky, Vice director Mobile. 0913.986181
		60. Minh Hai seaproducts import and export corporation	Tran Hiep Thuong, Vice director Mobile. 0913.893473
		61. Minh Phu seafood PTE	Bui Sy Tuan, Head of Business Office Mobile. 0903.616827

		62. Phu Cuong CO. LTD.	Nguyen Viet Cuong, director Tel. 0780.835059
		63. Quoc Viet seaproducts processing trading and import – export CO., LTD.	Ngo Van Nga, director Tel. 0780.830561
		32. Tan Thanh export products processing enterprise (AGRIMECO CA MAU)	Huynh Van Vung, vice director Tel. 0780.839058

Appendix 5

The Situation of The World's Seafood Market, Vietnam's And The MD's

A. INTERNATIONAL SEAFOOD TRADE

1. Aquaculture and Marine catch situation

In the last two decades, the world's seafood output increased fast. The increase was based mainly on aquaculture because the marine catch has been exploited at the maximum level. Although aquaculture began very slowly, it has developed quickly since the 1970s. In 1999, total aquaculture volume obtained 33.31 million tons with a value of $US47.8 billion (43.3% of the total value). The indicator was nearly 40 million tons in 2002. Asian countries are leading in aquaculture output in the world. Six of ten leading countries in this area are China, Japan, Indonesia, Thailand, Vietnam and the Philippines. Regarding seaproducts, shrimps, fishes and mollusk are main seafood species bred in order to supply of the world's market. Particularly, there are over 20 species of shrimp bred in the world, of which 80% of the volume from Tiger shrimp and Prawn. Three countries where Tiger shrimp bred with the largest volume in the world are Thailand, Indonesia and Vietnam.

In the capture aspect, natural seafood sources of the world have been thoroughly exploited. According to a FAO report, 25% of total global seafood source is exhausted, mostly in the Pacific sea. There is approximately 38% exhausted completely. Over 50% of seafood volume is caught from Asian countries. In 1999, total caught seafood output was 92.9 million tons. Four of 10 leading countries in the region where had the highest volume were China, Japan, Indonesia, and Thailand. This indicator had decline tend in 2002. However, the volume was still over 90 million tons.

Regarding natural caught shrimp, although shrimp breeding has expanded in several areas in the world, natural caught shrimp is still main source for trading (accounting for 75% of the total trade shrimp). From 1989, the shrimp volume from marine catch was about 2 times than that of aquaculture. But since 1997, this indicator was nearly 50%. Tiger shrimp is now over 50% of total bred shrimp. In the period 1991-2000, output of caught shrimp increased 55% (from

2.0 million tones in 1991 to 3.1 million tones in 2000). China had the most caught shrimp volume (1.023 million tones in 2000 accounting for 33%). India is followed with 352million tones and then Indonesia with 225 million tones. Vietnam was in the seventh position (81 million tones) following the US, Canada and Thailand in this aspect.

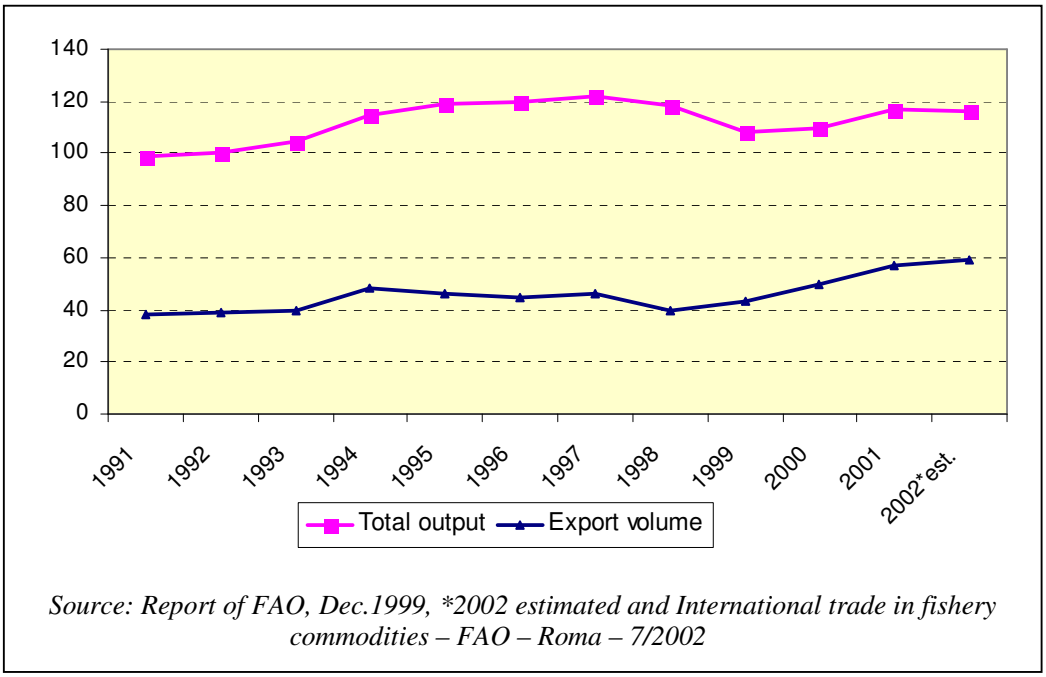
2. International seafood trade

2.1 Trade volume and value of international seaproducts

According to FAO, trade value of international seaproducts accounted for $US115.2 billion in 2000 (up 4.35% from 1999 and 39.6% from 1991). Compared with other agricultural products, trade seaproducts have increased at high level in terms of annually growth rate. In the last decade, there was unstable growth in trade value of international seaproducts over years. In 2000, trade value had the highest level ($UD115 billion) but it only increased 4.7% compared to 1996. Especially, this indicator was on the spot – negligible variety in the period 1996-1999.

2.1.1 The world's seafood export

The growth rate in exported volume was a few higher than that of total output during the period of 1999-2001. Specifically, the total world's seafood volume was approximately 100-120 million tons over the 1991-2002 period. The exported volume was about 35-50% of the total output with annually average export value over $US50 billion (Figure A1.1 and Figure A1.2). In addition, export value was approximately $US55.2 billion in 2000, of which developing countries accounted for over 50% and ASEAN countries kept 16%, respectively. Six of 10 leading export countries are from Asian countries. They are China, Chile, India, Peru, Taiwan, and Thailand. Particularly, total export value of the world's seaproducts estimated approximately $US57 billion in 2002. Thailand, China, Norway and the US were the largest export countries in terms of export value in the world (over $US 3 billion for each) although there were several difficulties in shrimp export due to high competition on price and strict inspection on quality of import countries. Thailand is leading country in shrimp export in 2002 ($US4 billion). Vietnam was also one of ten leading countries in terms of shrimp export at the same time ($US966.7 million).



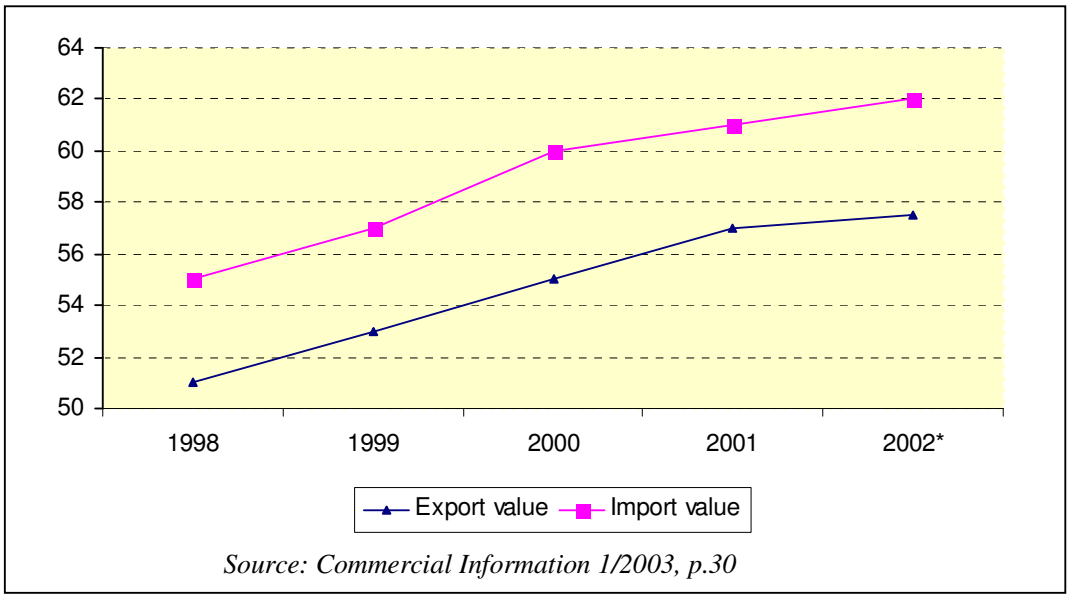
*Source: Report of FAO, Dec.1999, *2002 estimated and International trade in fishery commodities – FAO – Roma – 7/2002*

Figure A1.1 Total seafood output and export volume of the world (million tons)

Regarding export seaproducts, shrimp and salmon are high trade value products. Particularly, shrimp products have the highest export value in the world market. There are three kinds of exported shrimp products – frozen shrimp, fresh shrimp and canned shrimp. Frozen shrimp is leading product in terms of export value (accounting for 77% of the total exported shrimp value), then canned shrimp (20%) and with a small percentage of fresh shrimp (3%). Shrimp contribution to the world's value of seafood export is approximately 20%.

2.1.2 The world's seafood import

As the growth rate of export value, seafood import value of the world has increased over 4% in recent years. Asian countries are the largest market to import seaproducts (accounting for 35%-40%). Following are EU and North American markets. The largest seafood import countries in the world are Japan, the US, Spain, France, and China. These countries import annually over 56% of the total seafood market-share, of which 25% to Japan and 15-16% to the US (76% of total seaproducts consumed in the US from import – FAO 2002). Among imported seaproducts in 2000, shrimp has the biggest percentage in terms of import value (18.3%), then salmon (13.1%).



Source: Commercial Information 1/2003, p.30

Figure A1.2 Export and import value of the world's seaproducts (US$ billion)

3. Trend of the world's fisheries

The responsibility for food safety and quality will continue to be pushed through the food supply chain. All stakeholders in this chain will be required to share the responsibility for the integrity of the food supply. Those considered unreliable, will likely fall by the wayside. People and business that produce, manufacture, store, transport and retail the food we eat accept and acknowledge their individual responsibilities. However, running a business can involve managing other issues such as worker safety, animal welfare, environmental issues and many others. It also involves making a profit. It is therefore imperative that systems are available that provide the integrity of supply that is essential for consumer confidence, whilst at the same time contributing to the viability of the food industry.

Furthermore, according to the World's Fisheries Centre and International Food Policy Research Institute, the global aquaproduct output will not meet the demand of consumers in coming years because of the decline of fisheries source and increase of population. This will lead to a scarcity of seaproducts and increased price – if growth rate of fisheries is lower than that of population 0.4%, price of seaproducts can increase from 4 % to 16%. In 2003, the economies of seaproduct import countries, such as the US, Japan and EU are increasing at low level. Specially, consumption of seaproducts in these countries will increase when the price comes down. Export countries, such as Thailand, China and Norway will have negligible increase in terms of export volume at the

same time although they are trying to develop and promote in aquaculture, marine catch and processing. Particularly, shrimp products are still imported at high level in Japan and the US and there is a sharp increase in EU market because Asian export companies have effective measures to improve shrimp quality. However, the price will also increase from 7% to 10% compared to the year 2002. Predictions by FAO (2002 cited by The Ministry of Fisheries, 2002) reveal that the shrimp production of the world will increase by about 3.5% per year for the period of 2002-2005, and 3.2% per year for the period of 2006-2010. The demand for shrimp products is also expected to increase mostly in China, Taiwan, and Korea. In case of Vietnam, particularly, with the goal of a sea product export value of $2.3 billion in 2003, Vietnam is still among the 10 leading countries of the world in sea product export value, of which shrimp products represent a high percentage. Shrimp is still imported at high level in Japan and the US, and there is a sharp increase in EU market in recent years.

B. THE SITUATION OF VIETNAM'S SEAPRODUCTS

1. Vietnam's seafood production

Vietnam's total seafood output grew by over 2.2 times during the 1985-1999 period, of which output of aquaculture increased by over 2.6 times. Specifically, both marine catch and aquaculture strongly developed in recent years – 2,003 tons in 2000 up to 2,227 thousand tons in 2001 and 2,411 thousand tons in 2002 (Table A1.1). Besides, water surface area devoted to the breeding and rearing of aquatic products rose from 385 thousand hectares (1986) to 630 thousand hectares (1999), 652 thousand hectares (2000), 887 thousand hectares (2001) and 955 thousand hectares (2002). The reasons for these increase are (1) promoted policies related to fisheries development in terms of production and export of the Vietnamese government, (2) increase of seafood demand in the world, and (3) natural potential exploration thoroughly, especially natural grow areas in the MD. Aquaculture output accounted for nearly 50% in average of the marine catch output in the period of 1985-1999. From 2000, the growth rate of aquaculture output is over 65% of caught output between the years 2001-2002. According to the 5-year plan 2001-2005, the indicator of aquaculture volume will be equal to marine catch.

Table A1.1 The output of aquatic production in the period 1980-2002 (1000 tons)

Indicator	1980	1985	1990	1995	1998	1999	2000	2001	2002
Total output	559	808	979	1,344	1,668	1,827	2,003	2,227	2,411
Of which: - Marine catch	399	577	672	929	1,131	1,213	1,280	1,348	1,435
- Aquaculture	160	231	307	415	537	612	723	879	967

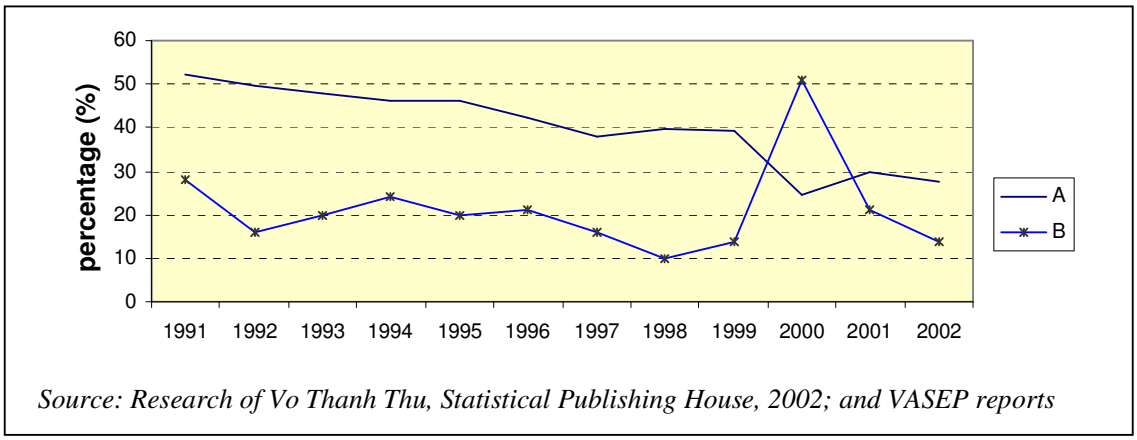
Source: Vietnam Seafood Exporters and Producers Reports

2. Vietnam's seafood export

2.1 Seafood export turnover

After a decade of development of the seafood industry (1990-1999), seafood export value increased 4.63 times. Seafood value accounts for average 30%-40% of total agriculture value (Figure A1.3) and 10%-14% of export turnover of Vietnam. However, the percentage of seafood value in total agriculture value declined in recent years. The reason is that even if the Vietnamese government issued several policies and regulations to promote fisheries development, bred fisheries, mostly shrimp, were continuously dead due to a polluted environment and different diseases.

In addition, Vietnam's seafood export value has the highest growth rate in the region in recent years (average 20% per year) and higher 100 times than the last two decades itself. Seafood export ranked third position (after petroleum and garments) in terms of Vietnam's export structure in the last two years (2000 and 2001)**.** However, although absolute value of seafood export turnover increased continuously over the period of 1990-2002, its growth rate reduced sharply from 51.4% in 2000 to 20.9% in 2001 and 13.8% in 2002. The reasons were main import markets of Vietnam that were in difficult situation like Sep.11 and the anti-dumping on catfish trade mark in the US, Yen depreciation in Japan, technical barriers to trade in EU, the US, Japan and China, other reasons related to quality inspection (e.g. sanitation performance standards), and high competition in the world's market.



Source: Research of Vo Thanh Thu, Statistical Publishing House, 2002; and VASEP reports

Figure A1.3 Contribution of seafood value to total agriculture value (A) and the growth rate of seafood export value (B) in the period 1991-2002

2.2 Export market

2.2.1 Market structure

Vietnam's seafood export markets have been continuously expanded and developed. The export market structure has been changed, creating a better and more stable balance, and form better condition for initiatives of the Vietnamese seafood enterprises in the world market. So far, Vietnam's seafood products have been distributed to 64 countries in the world. However, approximately 80% of the total export value are in four main markets – Japan, US, EU, and China (Table A1.2).

Table A1.2 The structure of export value by market in the 1999-2002 period (%)

Market	1999	2000	2001	2002
1. Japan	40.9	33.0	30.9	27.5
2. US	14.3	20.6	32.5	33.3
3. EU	9.6	6.2	5.7	5.3
4. China	14.6	19.8	17.4	9.7
5. Others	20.6	20.4	13.5	24.2
Total	100.0	100.0	100.0	100.0

Source: Information centre – Fisheries Ministry

From 1990, Japan is the largest import market of Vietnam's seafood. Between the years 2001-2003, the US market is a leading import country in this aspect. However, because there are many challenges in the US market in recent years such as Basafish and shrimp anti-dumping, Vietnam seafood export again concentrates in Japan market (for 2004, 31% and 25% of the total export value in Japan and in the US, respectively).

Regarding exported shrimp product, most of the marine catch and bred shrimp were exported to Japan (traditional customer) and the US. These markets captured over 70% of total exported shrimp value (Figure A1.4). In 2002, exported shrimp to the US market particularly accounted for 39.6% in terms of volume and around 48.3% in terms of value. Big-size shrimps are more appreciated by the US's importers along with high quality, safety and hygiene of the products. In this market, Vietnam's export shrimp was in second position in the world in terms of export value only following Thailand, and in terms of export volume in Japan market after Indonesia. Especially, the structure of exported shrimp export to EU decreased in the last two years because of strict quality inspection on zero tolerance of this market. So far, 61 SFCs of Vietnam have been approved to export to EU market with high quality of valued-added products. Eight bivalve mollusks harvesting areas with full hygiene and safety standards are ready to export to EU and nearly 100 units applying HACCP and adequate standards are approved for export to the US and Japan markets. From 70%-90% of exported seaproducts have inspected by the National Fisheries Inspection and Quality Assurance Centre (NAFIQACEN) before they could be exported to respond market standards.

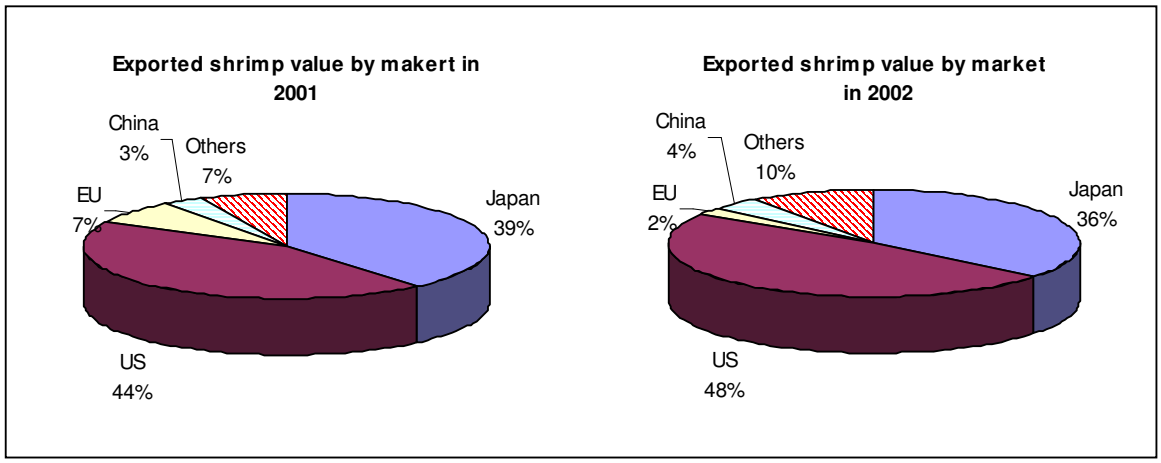


Figure A1.4 The structure of exported shrimp value by market in 2001-2002

2.2.2 Export product structure

There are four main groups of exported aquaproducts – Shrimp, catfish, dry products, and others (such as mollusk and cuttlefish) (Figure A1.5). Shrimp is the highest percentage in terms of export volume and value although the percentage is a big reduction in recent years - 61.82% in 1991, 52.1% in 1995, 30.6% in 1999, 22.8% in 2000, and 33.5% in 2001, and 26% in 2002 in terms of volume; 74.6%, 61.1%, 49.7%, 46.4%, 56.6% and 47.8% for the years in terms of export value, respectively. The reason for changing the shrimp export

structure among markets was high competition in the world market in terms of price and quality. Besides, the Vietnamese government as well as the Ministry of fisheries have encouraged the SFCs to diversify different aquaproducts in their export tend instead of only focusing on shrimp.

3. Introduction of the Mekong Delta

The Mekong Delta region, which lies in the southern part of Vietnam, is one of the seven ecological regions of Vietnam, namely *Northern Mountain and Midland, Red River Delta, North Central Coast, South Central Coast, Central Highland, Northeast South and Mekong Delta*. Its natural land is 39,713 sq. km, occupies about 12% of the total natural area of the country, and 21.1 % of total population in the whole country in 2002. It is bordered in the West by Cambodia, and in the East and in the South by the East Sea. The delta accommodates 12 southern provinces of Vietnam, namely, Long An, Tien Giang, Ben Tre, Vinh Long, Cantho, Tra Vinh, Dong Thap, An Giang, Kien Giang, Soc Trang, Bac Lieu and Ca Mau (Figure A1.6).

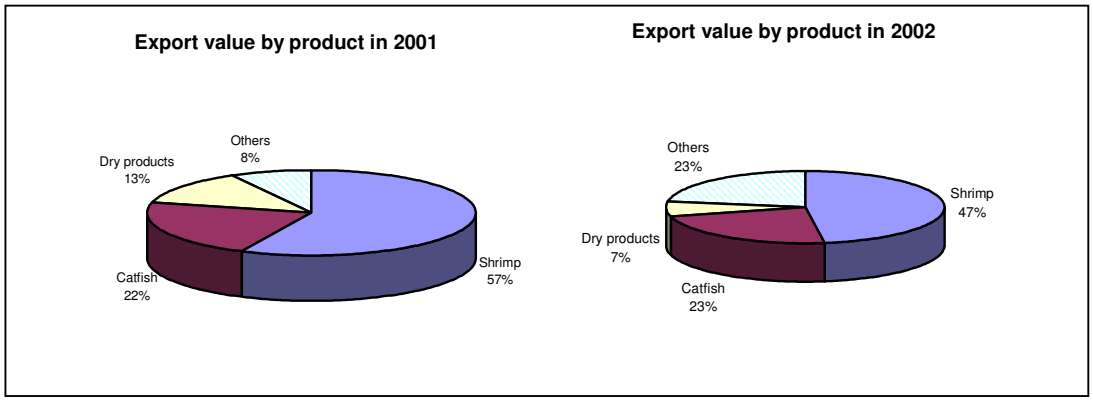


Figure A1.5 The structure of export value by product in 2001-2002

In recent years, the economy of the MD has reached a higher growth rate than that of Vietnam's indicators - 13.89% and 7.00%, respectively in 2002. However, it remains a less developed economic region. The starting point by any standard is low. GDP per capita was only $US 352, which is lower than that of the whole country ($US 439 per capita) in 2002. Average GDP growth rate was 5.6% in the period of 1991-1994 and 7.5% in the period of 1995-2000, which are lower than the average of the whole country - VN (7.9% and 7.4%, respectively). Also, during the period of 1998-2002, the economic structure in the MD has changed considerably. Specially, from 2001 the gross output value of agriculture of GDP went up, meanwhile gross output value of other sectors

such as industry, construction, and service increased negligibly because the Vietnamese government offered several policies that encourage local governments to expand areas for aquaculture in this region (Table A1.3). As a result, the growth rate of the MD's economy stems from agriculture, especially aquaculture. That is also the reason why its economy has depended heavily on agriculture and aquaculture representing a share of 52.7% of the whole economy.

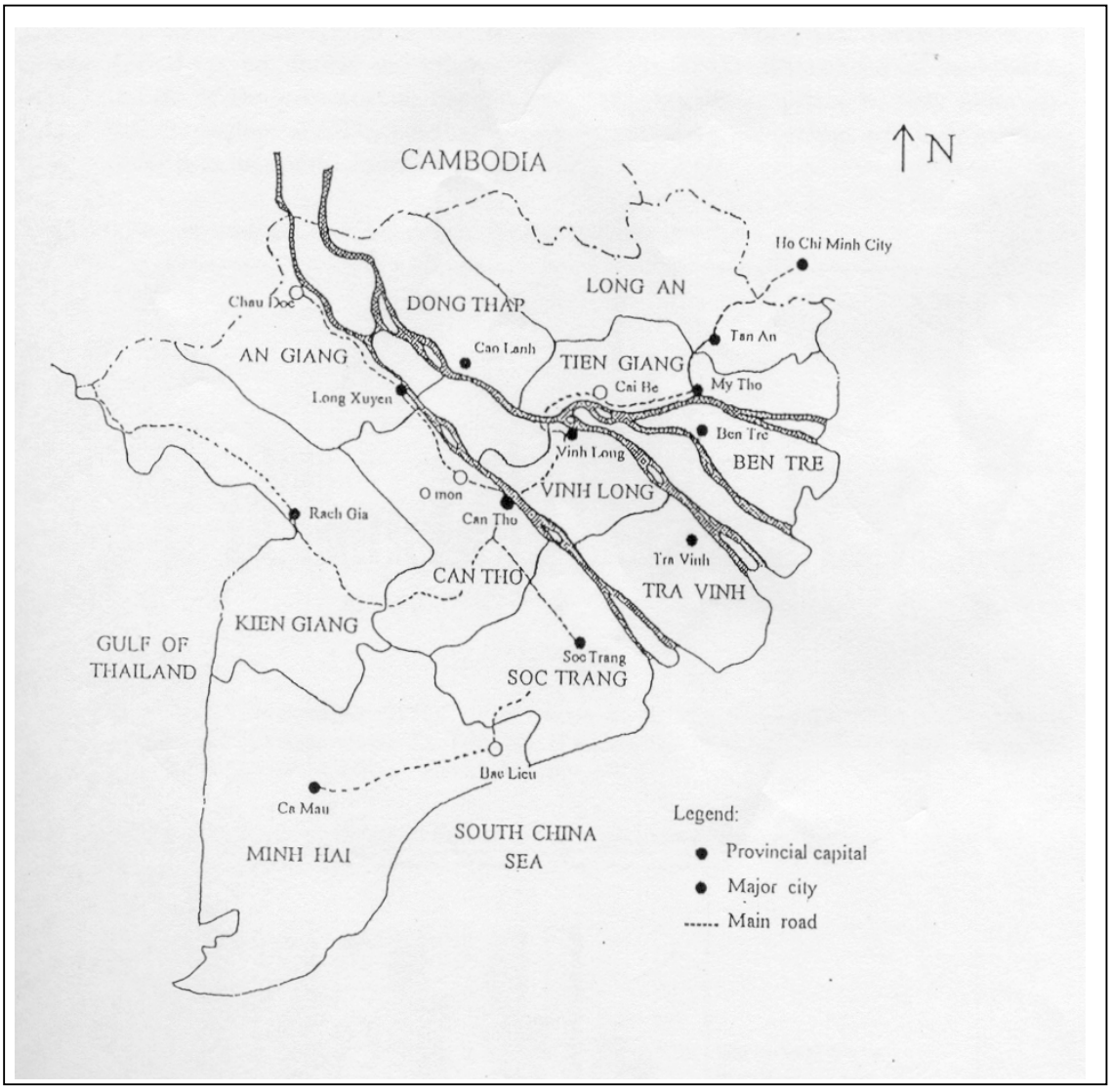


Figure A1.6 The Mekong Delta Map

Table A1.3 Economic structure of the MD compared to the whole country (1998-2002) (%)

Economic structure	1998		1999		2000		2001		2002	
	MD	VN	MD	VN	MD	VN	MD	VN	MD	VN
1. Agriculture	44.38	25.78	44.03	25.43	42.63	24.29	50.78	23.25	49.55	22.29
2. Industry	22.75	32.49	23.27	34.49	24.38	36.61	19.62	38.12	20.49	38.55
3. Service	32.87	41.73	32.70	40.08	32.99	39.10	29.60	38.46	29.96	38.46
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Statistical year books 1999-2002, vneconomy.com.vn

Furthermore, the MD accounts for 45.8% of the whole country's agricultural food production. With over 700 km of coastline and a dense network of rivers and canals, the MD is also the biggest potential area for aquaproducts. Specially, the growth rate of fisheries output increased over 70% in the period of 1995-2001. In agriculture structure in the MD, aquaculture percentage accounts for 30%-35% - twice compared with that of in the nation. It is said that aquaproducts from the MD make up over 50% of total output of the country, and exported seafood accounts for 58-60% of gross exported sea-product value of the nation, especially export shrimp volume and value. Particularly, gross output of breeding shrimp and culture area in the region captured approximately 75-80% and 85-90% of the whole country in the period 2000-2003, respectively (Table A1.4).

Table A1.4 Shrimp cultured areas and output in Vietnam and the MD

Indicator	1991	1994	1999	2000	2001	2002	2003*
1. Vietnam							
. Cultured areas (ha)	222,000	253,000	203,232	259,688	449,275	478,785	496,975
. Output (tons)	35,600	65,600	65,282	103,845	162,713	193,973	223,895
2. Mekong Delta							
. Cultured areas (ha)	89,605	180,588	173,510	221,066	398,964	417,398	429,114
. Output (tons)	34,386	41,596	49,624	81,875	127,899	153,122	172,136

Sources: Truong and Tham (1996); Hai et al. (1998); the Ministry of Fisheries (1995-2003).

(*) Planned data.

Regarding breeding shrimp, only eight of twelve provinces in the MD produce shrimp. Ca Mau is the leading province in terms of breeding, output as well as export value in this region. Following are Baclieu and SocTrang provinces' which have a long coastline. In 2001, the growth rates of shrimp culture area and output in the MD were 80% and 56% compared with 2000, respectively. Similarly, this indicator was 4.6% and 19.7%. There was a sharp increase of

shrimp culture area and shrimp output in 2001 because approximately 110,000 ha of rice fields in Soctrang, Baclieu and Camau provinces were converted into rice-shrimp areas. Moreover, the growth rate of culture area was higher than that of the output due to 50-70% of these areas lost the first crop of the year.

Recently, the development of the shrimp cultured areas and production of the provinces in the Delta is represented in Table A1.4. The integration of mangrove-shrimp and rice-shrimp farming, and improved extensive mono shrimp practices are common in the Delta. However, characteristics of the three shrimp grow-out systems can be described more specifically as follows (Tuan et al., 1996; and Ministry of Fisheries, 1999-2003):

- *Extensive systems* exist broadly in the Mekong Delta in a range of different forms. Criteria for this type of shrimp farming are that they are without stocking or have a low stocking density of artificial shrimp seed (natural or wild shrimp seed are common, less than 5 post larvae per square meter are often added to form the improved extensive systems). They utilize natural feed with minimum levels of feeding while the water exchange is mostly the difference between high and low tides. Average shrimp yield per crop per ha varies from 0.3 to 0.87 tons. The three most common types of extensive systems are: (i) integrated mangrove-shrimp; (ii) integrated rice-shrimp; and (iii) mono extensive shrimp. The first type exists in each province, but is more popular in Ca Mau, Ben Tre and Kien Giang provinces. The second type is common in Soc Trang, Bac Lieu, and Ca Mau. The third type can be observed in every coastal province in the Delta.
- *Semi-intensive systems* have been gradually utilized in practice since the beginning of the 1990s in the Mekong Delta. Criteria for this type of shrimp farming are: higher stocking densities of artificial shrimp seed (from 5 to 15 post larvae/m^2); wild shrimp seed and natural feed are not commonly used while more artificial/commercial feed is added; water exchange is controlled, mostly by pump; sometimes, aeration is used. Average shrimp yield per crop per ha varies from 1.2 to 2.65 tons. This type of shrimp farming exists in every province in the Delta. It is more common in the places where the soils are good for pond construction and the smaller farm size is popular, for example, in Bac Lieu, Soc Trang, Tra Vinh and Ben Tre provinces and to some extent, in Long An and Tien Giang provinces.
- *Intensive systems* have only been used in the last few years and have slowly been developed in the Mekong Delta. Criteria for this type of shrimp farming are: very high stocking densities of artificial shrimp seed (15-50 post larvae/m^2); good control of the pond environment including water exchange and treatment, feed supply and aeration. Average shrimp

yield per crop per ha varies from 2.5 to 5.0 tons, and some farms reach 7 tons. This type of shrimp farming has been recently applied in the Delta, especially in Tra Vinh, Soc Trang, and Bac Lieu provinces. However, in most of the coastal areas of the Delta, the implementation of this system seems to be more difficult than in the Central regions of the country due to higher levels of technical and financial investment required, as well as unsuitable soil conditions. The provinces from Long An to Bac Lieu and some parts of Kien Giang and Ca Mau provinces have been considered for future development of this system.

C. Vietnam Economy and Fisheries Industry Development in 2003-2004

1. Vietnam Economy in 2003-2004 – an overview

The socio-economic tasks of 2003-2004 were basically fulfilled: 7.24% and 7.5% in GDP growth rate, the highest growth rate ever achieved over the past 7 years and higher than many countries in the region, over fulfilment of many major targets. In 2003, economic structure by sector includes Agriculture, forest and Aquaculture sector 22.30%, Construction and Industry 39.97% and services 38.23% (growth 3.20%, 10.34% and 6.57%, respectively). State budget revenues surpassed expectations by 7.1% and grew by 11.3% as compared with 2002. During 1990-2003, the average annual economic growth rate attained over 7%, with the following breakdown: agriculture up by about 3-4%, services by 6-7%, industry 12-14% and particularly industry in 2003 up by 16%. There was a substantial growth in mobilized resources for development as evidenced by the ratio of nationwide investment to GDP, which grew 35.6% in 2003 although there were many difficulties, such as negative impact arising from natural calamities, the war in Iraq, the SARS epidemic, and ever fiercer trade competition.

In the context of adverse world developments, global economic downturn, and decline in the economic and export indices of many countries, Vietnam's economic relations show ample signs of picking up in 2003. Its export turnover reached $19.9 billion, up by 20.26% against 2002. That is two times than that of planed target. Especially, Aquatic-product export turnover in 2003 reached $2.3 billion (up 8.6% compared to 2002) and $2.4 billion in 2004.

2. Fisheries Industry Development in 2003 – 2004 – an overview

In 2003, although there has been many difficulties and variety in the fields of the world seafood markets, Basa and shrimp cases in the US market, reduction of China, Hongkong and Taiwan markets due to SARS epidemic and trade barriers, the Industry of Fisheries keeps a increase in all aspects – culture, marine catch, processing and export:

- *Culture:* culture areas are over 1 million hectare with the total volume 1.110.138 tons, of which tiger shrimp 210.000 tons (up 5.26%, 15.06%, and 11.10% compared with 2002, respectively). Besides, the production of shrimp seed culture was approximately 25 billion post larvae and 20 billion nauplius.
- *Marine catch:* So far, Fisheries Industry has 83.100 boats for catching, of which 6.259 offshore boats (50% of the offshore boats are effective, 35% break-even and 15% ineffective). Total catch output in 2003 is 1.426.223 tons (up 3.34% against 2002).
- *Processing:* The SFCs have enhanced value-added products in their product structure, quality improvement and assurance, technological improvement and renew. Specifically, in 2003 value-added products increased 30.5% volume and 73.7% value. At present, there are 160 of the total 332 SFCs that have obtained quality, safety and hygiene standards.
- *Markets and export:* In 2003 Vietnam's seafood products were exported to 75 different countries in the world. However, the highest percentage is focused on the US, Japan and the EU. So far, the SFCs are allowed to export the EU market are 100, 197 SFCs to Taiwan. The export value of the Industry in 2003 is $2.3 billion.

In 2004, although Vietnam's SFCs in general have faced many challenges regarding very strict inspection on antibiotic residues, shrimp anti-dumping, and high export taxes of main import markets (The US, Japan and EU), the export value was still increased up to $2.4 billion. To gain this result, the industry and their stakeholders have had efforts to improve seafood safe and quality in general and shrimp product in particular.

Following are the figure that shows Vietnam seafood export value in general and shrimp in particular in 2003. Generally, more than 60% of Vietnam seafood export value are exported the US and Japan markets. Main export products to these markets are shrimp and catfish. Particularly, in 2003 there are 36% of shrimp value exported to Japan and 48% to the US market. From 2004, Vietnam's shrimp export has faced with big difficulties and high competitions in the US market because of shrimp anti-dumping case nowadays with high tax compared to that of Thailand and some other shrimp export countries. However, the percentage of shrimp export value is still leading (53% of the total Vietnam's fisheries export value in 2004).

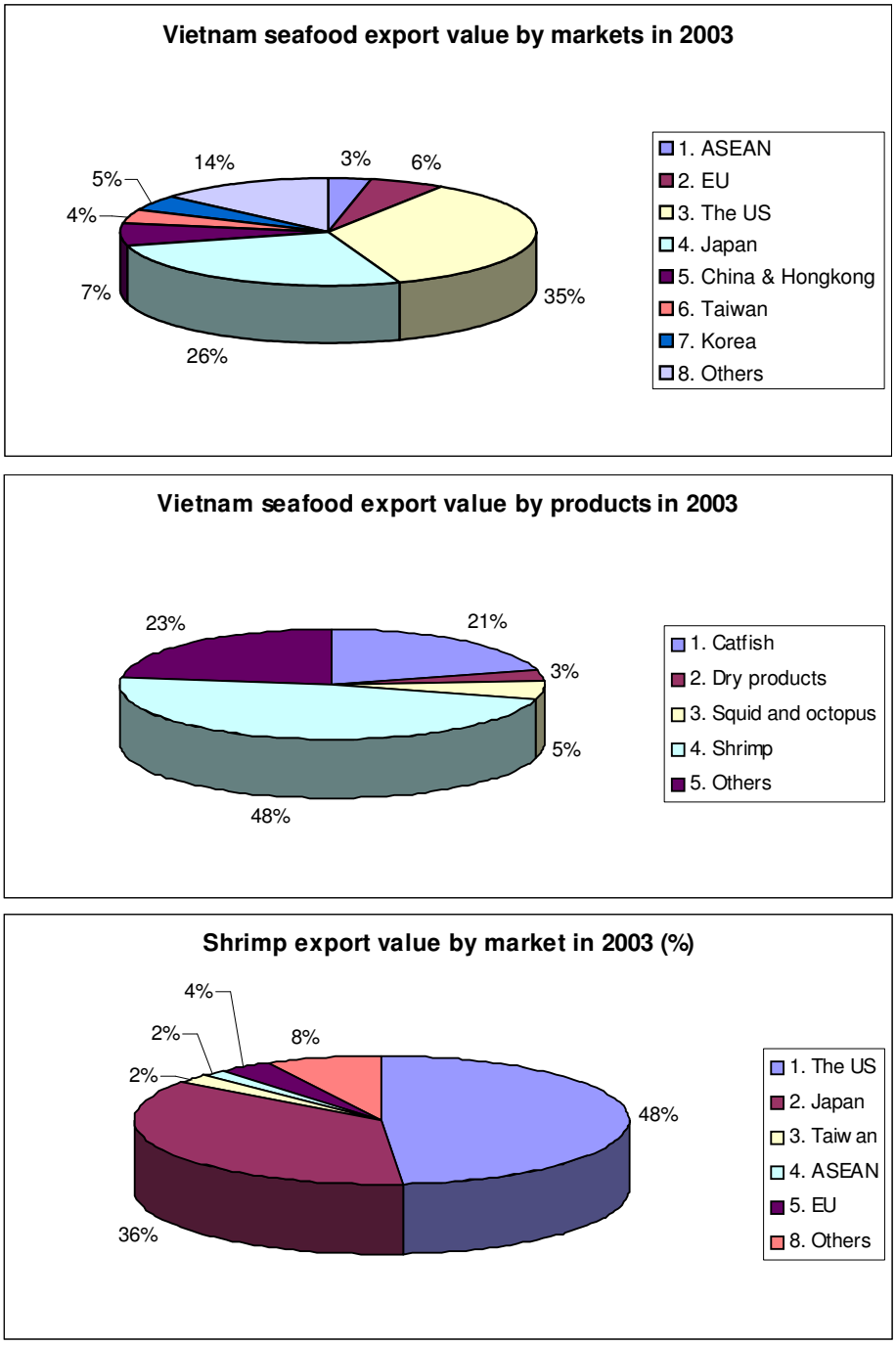


Figure A1.7 Vietnam seafood export value in 2003

Appendix 6

Introduction of The 12-Stages Procedure For An HACCP Implementation

1. Assembling of an HACCP team

An HACCP study requires multidisciplinary skills and all relevant departments involved in food production should be represented. This means individuals and specific knowledge and expertise appropriate to the product and process, but also people directly involved in daily activities, as they are familiar with variability and limitations of the process. The team should, at least, have the following constitution:

- A quality assurance/quality control specialist, who has knowledge on microbiological and/or chemical hazards and associated risks for the particular product group.
- A production specialist, who is responsible, or is closely involved with, the production process under study.
- An engineer, who has knowledge on hygienic design and engineering operation of process equipment under study.
- Other specialist can be added to the team like buyers, operators, packaging experts, distribution experts, and a hygiene manager.
- A member of the management to ensure management commitment.

In small and medium enterprises like SFCs in the MD, often not all expertise is available and it is recommended to involve external support or information to ensure that the team meets all required skills. In fact, each SFC in the MD has a department of quality control or technical department. Generally, members of HACCP team are from this department, not combination from the others. Especially, top managers are not included in the team. As a result, there is a limitation of multidisciplinary skills and all relevant departments involved in food production.

2. Description of the product and its distribution

The team should make a full description of the product and its distribution. The description should include:

- Composition and physical features of final product (pH, gas tension)
- Process information (e.g. production methods used)
- Method of packaging
- Required shelf life
- Storage and distribution conditions along the chain (e.g. frozen, refrigerated, shelf-stable)
- Legislative product requirements
- Instructions for use and storage by consumers

In case of the SFCs in the MD, almost all of them (96.9%) have the teams who describe their products and distribution. This is a step that the companies do their best. There is no complaint from customers about what related to description of products and distribution so far. However, process information and method of packaging have not been described in details to the brochure in order to introduce customers.

3. Identification of intended use and consumers

To encompass any special considerations, the intended use of the product by consumers should be defined, e.g. is the product intended for special groups, which put higher demands on food safety like babies or people with reduced resistance? Likewise, intended use should be established when applying HACCP in production. Particularly, the SFCs in the MD have focused on intended use of their products by customers in each foreign market – frozen or value-added seafood products with hygiene and safety. The companies have recognized customer's needs in terms of the intended use of the products throughout the agencies or importers or customer's orders. However, the SFCs lack modern equipment to control quality and inspect the hazards of final products.

4. Development of process flow diagrams

Prior to the actual hazard analysis, it is necessary to examine the production process thoroughly. Therefore, a process flow diagram must be drafted, which provides an unambiguous, simple outline of all steps involved in the process. There are no rules for preparation of flow diagrams, except that each process step and the sequence of steps should be clearly outlined. In the process diagram, sufficient technical data for the study must be provided, such as all raw materials/ingredients and packaging used (including relevant microbiological, physical and/or chemical data); time/temperature, process conditions; storage and distribution conditions; efficacy of cleaning and disinfection procedures;

personal hygiene practices. In fact, the SFCs in the MD have perfectly performed this step. They developed process diagram with all clear steps from receiving materials to package and storage of finished products.

5. On-site verification of flow diagram

In case of an existing line, the HACCP team should inspect the operation process to verify that each step in the flow diagram is accurate representation of the actual situation. Inspections of night- and weekend shifts should also be carried out. In case the analysis is being applied to the proposed line and verification will not be possible, the team must ensure that the flow diagram represents the most likely processing options. Actually, the companies in the MD have only focus generally on process procedure diagram. However, the typical data to draw the diagrams on internal computer system is limited, such as the data for all raw materials/ingredients and packaging used, time/temperature history of the chain, process conditions, storage and distribution conditions, product loops for recycling or rework, routes of potential cross-contamination, high/low risk area segregation, overview of floors and layout of equipment, features of equipment design, efficacy of cleaning and disinfection procedures, personal hygiene practices, and consumer-use instructions.

In addition, based on company's scale, it can organize two or three shifts per day and night in process. Each line is managed by a manager. After finishing the shift, managers of the lines have to write a report to the quality controller who inspects and observes the shift. But, the managers of the lines are people who have fisheries awareness but not quality awareness. Moreover, the flow diagram is seldom adjusted in short term except change in technology and production or product lines.

6. Conducting of HACCP analysis *(principle 1 – potential hazards along the production chain must be identified and analyzed)*

In this stage the HACCP team must perform the hazard analysis. The result of this step is a list of significant hazards, which must be controlled in the process. Hazard analysis consists of hazard identification, hazard analysis (evaluation), and listing of relevant preventive measures. Practically, the SFCs in the MD have recognized microbiological, chemical and physical hazards and listed relevant preventive measures. Specifically, the following figure shows the hazards that can mix into shrimp materials and final products in the supply chain.

In addition, other hazards related to shrimp quality are changes of shrimp colour, taste, smell, level of incorrect ingredients, worker's hairs and fly foots. According to FDA (Food and Drug Authority) of the US, The companies, that have successful HACCP program, have to build enough five important

ingredients: (1) identifying and describing the hazards, (2) determining critical control points, (3) critical limits, (4) documents for observation and (5) keeping files**.** And, the companies can be approved performance all HACCP plan when they do well three following ingredients – observing, keeping files and acting for solving the hazards.

- ***Physical hazard***

Hazard	Reason for infection	Harmful	Prevention method
Metal pieces	1. From marine catch and cultured process, storage and transportation process to the company. 2. From processing tools and equipment. 3. From cheating of the farmers and wholesale buyers.	- Prejudicing digestible system to human	1. Shrimp material Suppliers' insurance 2. Maintenance of processing tools and equipment. 3. Using means to discover metal pieces

- ***Chemical hazard***

Chemical hazards, that can infect to shrimp product throughout the supply chain, are environment pollution, antibiotic residuum, pesticides, various types of cleaning medicines, chemical substances for product maintenance, sterilization, adjuvant, etc.

Hazard	Reason for infection	Harmful	Prevention method
1. Residuum of pesticides and antibiotic.	Shrimp materials catch and cultured from water pollution.	- Causing Cancer - Prejudicing digestible system to human	- Shrimp materials supplied of controlled area by authority or from loyal suppliers - Use of Elisa equipment to discover infections
2. Infection of sulfite	Use for maintaining shrimp materials	- Causing allergy	- Guarantee not to use sulphite of suppliers. - Use of test paper

- ***Biological hazard***

Shrimp products can be infected by Chemical hazards, such as bacterium, virus, parasite and protozoan.

Hazard	Reason for infection	Harmful	Prevention method
1. Coliform, Staphylococusaureus, and E.coli	From shrimp food, water, and processing tools.	Prejudicing digestible system to human	GMP*
2. Salmonella (SPP)	From water, and processing tools.	Causing typhoid	Well-done cook

Most of SFCs in the MD have not built or planned sufficiently by five or three ingredients in details to control the shrimp quality like FDA indicators as well as market requirements. The reasons for this are (1) high infrastructure investment costs – costs of improving processing technology, means and tools, costs of controlling quality, and costs of training. (2) Lack of suitable conditions to apply these standards (finance, management, qualified managers and workers, methods, professional equipment and means, and materials).

7. Determination of Critical Control Point *(principle 2 – CCP's must be identified, which must be monitored and avoid or minimize occurrence of hazards)*

A Critical Control Point (CCP) is a step (i.e. point, procedure, operation, or stage in the food production system) at which control can be applied, and where control is essential to prevent or eliminate a food safety hazard or to reduce it to an acceptable level. CCP's are unique for each process at each facility. There is no such thing as a standard CCP returning in every food production process. There is no limit on the number of CCP's that maybe identified in the flow diagram. Practically, the SFCs in the MD have focused on six important points in the chain that are controlled. They are (1) buying raw materials, (2) material receiving and handling, (3) processing, (4) packaging, (5) storage and (6) before transporting to export. The hazards are easy to occur these steps. The companies have used many different methods and points of time to observe, such as at the beginning of the shift, each block of the products, a period of time or frequency. Nevertheless, there are around 50% of the SFCs that determine above six CCPs and control them.

8. Establishment of critical limits of each CCP *(principle 3 –the hazards should be controlled at each CCP)*

Each CCP will have one or more preventive measures that must be controlled in order to assure prevention, elimination or reduction of hazards to an acceptable level. For each preventive measure, critical limits (target plus tolerances) must be established. Critical limits can be set by legal and/or other requirements, or can be based on information from hazard analysis or quantitative risk analysis.

The SFCs have established critical limits for the CCPs to control microbiological, chemical and physical hazards. These limits are based mainly on Vietnam's quality standards that resulted from internal hazard analysis provided VASEP and NAFIQACEN and external quality standards (quality requirements of import markets). In fact, the companies lack equipment and specialist who can completely control critical limits.

9. Establishment of monitoring system for each CCP *(principle 4 – surveillance systems for regular monitoring or observation of CCPs)*

Monitoring is the scheduled measurement or observation of a CCP relative to its critical limits. It is required to assess if the CCP is under control and to provide written documentation for verification. For monitoring purposes usually physical and chemical tests and visual inspection are applied. Microbiological testing is seldom an effective means of monitoring because of time required to obtain results ((NACMCF, 1998).

Regarding procedure to observe and monitor critical limits, the SFCs in the MD have not clearly established monitoring procedure. For instance, there is no specialist who is responsible and monitor the critical limits, what is monitored, why, how, where and when. As a result, monitoring data is not recorded sufficiently and frequently.

10. Establishment of a corrective action plan *(principle 5 – Corrective action must be established including measures which should be taken whenever an inadmissible deviation is recorded at CCPs)*

If monitoring data reveals that he process has deviated from the critical limit, then a corrective action must be taken. Actions must ensure that the CCP has been brought under control. The corrective action plan must provide information about which actions should be taken when the process exceeds critical limits, and who is responsible for implementation and recording of corrective actions.

From the results of step 7 to step 9, there are some main points in the processes that are controlled and monitored by the quality controller at the company. Most of the SFCs in the MD have no basically corrective action plan. It is simple that

they discover something wrong and then suggest to be adjusted and correct with given measures. Therefore, corrective action is still limited. However, there are approximately 18% of the SFCs in the MD (six of ten leading companies in seafood export in Vietnam) who have enough conditions to apply quality systems. They established perfectly critical limits and corrective action plan.

11. Verification of the HACCP plan *(principle 6 – verification procedures must be established for verification of functioning of the HACCP system)*

Verification is defined as those activities, other than monitoring, that determine validity of the HACCP plan and that the system is working according to plan (NACMCF, 1998). In fact, all relevant records and documentation from basic input for verification of the HACCP system must be established.

Establishing procedures for verification, that the HACCP is working correctly, depend on the conditions of each company. There are 87.5% of the SFCs in the MD that have applied HACCP and also have HACCP program verification – from prevention to finishing product testing, records and writing report. However, a big limitation to all of the companies is that the verification is not frequent and continuous.

12. Establishment of record keeping and documentation *(principle 7 – record keeping and documentation relating to the HACCP plan must be developed for effective management)*

Documentation and record keeping are essential for the HACCP system. The approved HACCP plan and HACCP procedures must be documented, whereas relevant data obtained during operation must be recorded. Examples of documentation are process flow diagram, conductance of hazard and CCP analysis. Record examples include information about used ingredients, processing data, specifications of packaging materials, temperature records of storage and distribution, deviation and proceeded corrective action records and employee training records.

All of SFCs in the MD, that have applied the HACCP, established record keeping and documentation. What they did that are recorded keeping and documented – CCP records, critical limit records, records associated with deviations, records and verification, records review and retention and regulatory access. Because these are not observed and monitored frequently and continuously, data in documents and record keeping is still limited in updating.

Appendix 7

Plan For The Framework Test In SFCs

A. TEST PLAN

1. Contact with test companies

First of all, contacting two test companies, one in Bentre and the other in Camau, is conducted. The discussion what planned to test (the quality management framework at level company) with the directors and people in the Department of quality control in each company is organised. In addition, general information about the companies was also collected in these visits.

Results:

- Agreement with the companies to test the quality management framework.
- Applicable HACCP procedures and principles and other related criteria
- Report of general situation of two test companies

2. Pre-applying the framework test

- Translating the contents and criteria related to the quality management test framework into Vietnamese and then sending it to the leaders and quality control staffs of the companies.
- Discussing how to apply the quality management test framework at the company with the leaders and people involved in quality control.
- Collecting information related to companies' suppliers (interviewing both quality control staffs and their suppliers).
- Collecting information related to shrimp quality system at the company, employee, technological investment, managerial level and distribution quality control in detail.
- Collecting information related to company's stakeholders in the chain for quality assurance objectives.

Results:

- Vietnamese version of the test contents and criteria of the quality management framework.
- Reports of information related to companies' suppliers, shrimp quality system, technology and management.

- Report of the deficiencies from the company's stakeholders in the chain for quality assurance.

3. Application of the quality management framework test

- Description of the progress for testing HACCP procedures and principles at the company: starting and ending time, who was responsible, the staffs' experiences, the test contents (appendix 6 and part B2).
- Implementing the test contents of the HACCP
- Describing the practices and test results
- Comparing the test results with the HACCP principles and criteria
- Comparing the test results with given HACCP implementation documents of the company
- Identifying the quality gaps of HACCP implementation
- Identifying other quality gaps in each aspect of the quality system process:
  - Technological gaps
  - Managerial gaps
  - Quality system gaps
  - Employee gaps

Results:

- Report of discussed results of the framework test progress at the company
- Report of test contents and results
- Report of technological, managerial, quality system and employee gaps in the company.
- Report of practical HACCP program implementation in the company
- Report of the HACCP implementation gaps in the company
- Report of other gaps in the company

4. Suggestions for developing a quality improvement to cover the gaps and deficiencies

- Developing quality improvement process
- Distributing the improvement process to the test companies
- Suggesting other recommendations related to State management on quality management in shrimp supply chain.

Results:

- Reports of the improvement process
- Report of company's distribution

- Other measures and recommendation in the short term and long term the quality management framework and shrimp quality assurance and improvement in the chain.

B. THE NEEDED INFORMATION FOR TEST DESCRIPTION AT THE COMPANY

B1. Interviewing SFCs' leaders and key staffs about:

1. Suppliers (contents of Supplier Quality Management)

1.1 How did the company establish a stable relationship with their suppliers?
1.2 Which criteria did the company use to select their suppliers?
1.3 Was product quality a criterion for supplier selection?
1.4 Which activities did the company use to participate with there suppliers?
1.5 Did the company evaluate the performance of their suppliers? (by price, quality or delivery)
1.6 What methods did the company use to audit supplier quality? (inspection of product, meetings with supplier to review quality status, review of statistical process control, or test)
1.7 What methods/measures did the company use to improve supplier quality? (training, other programs related to quality improvement)
1.8 How did the company communicate with their suppliers to get necessary information? (drawings, specifications and other necessary data)

2. Quality systems (QS) (HACCP, ISO and others)

2.1 What quality systems did the company currently use?
2.2 What was the level of implementation of each system?
2.3 What were the limitations to these quality systems?

3. Employee structure

3.1 Level of education (percent of high school, university and post-graduate)
3.2 Managerial participation of the employee (%)
3.3 Trained percentage on quality management and HACCP of employee
3.4 Organizational and managerial structure (%)

4. Level of technological investment (TI) related to quality improvement and assurance

4.1 Kinds of invested equipment and technology
4.2 Invested costs and sources
4.3 The percentage of the current need for TI realised by the company
4.4 Technological and equipment problems (quantity, quality, budget or managerial issues)

B2. Description of HACCP implementation in the companies

1. Prerequisite programs (GMP and SSOP)

1.1 Did the company perform GMP and SSOP? Which level? Any certificate about GMP and SSOP?

1.2 Limitation of implementing GMP (managerial, technological and other issues)

1.3 Limitation of implementing SSOP (managerial, technological and other issues)

2. Description of HACCP implementation in the company

2.1 Assemble HACCP team

- The company established a HACCP team or an individual to control product quality?
- Who were included in the team (or individual)? (education level, HACCP and other quality standards training? What was their daily responsibility related to quality management?
- How much time (percentage) did the quality team spend on HACCP and was this time sufficient?

2.2 Describe the product and its distribution

- How many products were produced in the company? How about shrimp products?
- Were they described sufficiently about:
  + Composition and physical features of final product
  + Process information
  + Method of packaging
  + Required shelf life
  + Storage and distribution conditions along the chain
  + Legislative product requirements
  + Instruction for use and storage by customers

2.3 Identification of intended use and consumers

- In which market segments are products distributed?
  + Is the product intended for special groups?
- What are the potential risks if the consumer abuses the products?
  + Which pathogens might multiply under excessively warm storage conditions inside the consumer's home or business?

2.4 Development of process flow diagrams

- Did the company develop process diagrams as a tool for prior to the actual hazard analysis to examine the production process?
- In the process diagram, was there sufficient technical data for the study provided?

+ All shrimp materials/ingredients and packaging used (microbiological, physical and chemical data)
+ Time/temperature history of shrimp materials, intermediate and final products
+ Process conditions like, floe rate, temperature, time, pH, gas tension etc.
+ Storage and distribution conditions
+ Product loops for recycling or rework
+ Routes of potential cross-contamination
+ High/low risk area segregation
+ Overview of floors and layout of equipment
+ Features of equipment design
+ Efficacy of cleaning and disinfections procedures
+ Personal hygiene practices
+ Consumer-use instructions

- Did the flow diagram cover all steps in the process and which were directly under control of the company?

2.5 On-site verification of flow diagram

- Did HACCP team inspect the operation process to verify that each step of the flow diagram was an accurate representation of the actual situation?
- Were all shifts inspected and were these inspections carried out?
- Did the team ensure that the flow diagram contained the most likely processing options in cases where analysis and verification was not possible?

2.6 Conducting of a hazard analysis in the company (principle 1)

- For conductance of the hazard identification, did the HACCP team review all potential hazards?

  + Shrimp materials, ingredients and semi-finished products (*e.g.* residues of pesticides, initial content of micro-organisms)
  + Where did contamination occur by equipment, personal or environment?
  + Facility design, *e.g.* was there an adequate separation of raw and processed materials guaranteed?
  + Equipment design, *e.g.* were appropriate time-temperature conditions obtained, was it be properly cleaned and sufficiently controlled?
  + Surviving of process steps, e.g. heat-resistant toxins
  + Packaging, *e.g.* was packaging resistant to damage, temper-evident, did it contain proper labelling and instructions?

+ Conditions of the shrimp which favour microbial growth, e.g. composition, pH, a_w
+ Deviations in managing the process, e.g. process delays, technical trouble.

- In hazard analysis (evaluation), did the HACCP team evaluate potential hazards?
  Wherever on:
  + Severity of potential hazard, *i.g*. magnitude and duration of illness or injury
  + Likely occurrence of hazard, which is usually based on a combination of experience, epidemiological data, and information in the technical literature
  + Qualitative and/or quantitative evaluation of the presence of hazards
  + Number of people potentially exposed to the hazard
  + Age/vulnerability of those exposed
  + Survival or multiplication of micro-organisms of concern
  + Production or persistence in foods of toxins, chemical or physical agents
  + Conditions leading to the above

- In other words, which hazards were of such a nature that their elimination or reduction is essential for production of a safe food?
- Did the team use control measures for each hazard at different stages?
- Have control measures been described as those actions or activities that are required to prevent or eliminate hazards or to reduce their occurrence to an acceptable level?
- Were other control measures required for barrier hygiene or appropriate temperature control in the storage and distribution chain?
- Did the HACCP team consider education and training to improve knowledge and experience as a form of control measures?

2.7 Determination of Critical Control Point (CCP's) (principle 2)

- Which control was applied at the company? Where and why?
- Were CCP's unique for each process at each facility?
- Were CCP's determined by applying the CCP decision tree?
- How to control CCPs?
  + Did preventive measure (s) exist?
  + Did the step eliminate or reduce the hazard to an acceptable level?
  + Could contamination with the hazard occur at unacceptable levels or increase to unacceptable levels?
  + Will a subsequent step eliminate or reduce the hazard to an acceptable level?

2.8 Establishment of critical limits for each CCP (principle 3)

- Did each CCP have one or more preventive measures that were controlled in order to assure prevention, elimination or reduction of hazards to an acceptable level?
- For each preventive measure, were critical limits established that could be based on what? (legal/or other requirements, or information from hazard analysis or quantitative risk analysis).

2.9 Establishment of a monitoring system for each CCP (principle 4)

- Was the monitoring system and procedure for each CCP able to detect loss of control at the CCP concerned?
- Did the monitoring system and procedure contain information about how to adjust the process before a deviation occurred?
- Did the monitoring system and procedure include the assignment of a person with relevant knowledge, who evaluated and signs the monitoring data?
- If monitoring was not continuous then also was the frequency mentioned?
- For monitoring process were physical and chemical tests and visual inspection applied? (microbiological test is seldom an effective means of monitoring because of the time required to obtain results).

2.10 Establishment of a corrective action plan (principle 5)

- Did the team ensure that the CCP has been brought under control?
  + Determination and correction of the cause of non-compliance (non-conformance)
  + Characterisation of the non-compliant product (non-conformance product)
  + Recording of taken corrective actions
- Did the corrective action plan provide information about which actions should have been taken when the critical limits were exceeded, and who was responsible for implementation and recording of corrective actions?

2.11 Verification of the HACCP plan (principle 6)

- Did the company include the following topics in verification content?
  + Validation of initial HACCP plan to determine if the plan had been properly developed (are all potential hazards identified?). Validation can be performed by experts or scientific study.
  + Verification of actual execution of the HACCP plan in practice; was the plan correctly followed, were CCP's monitored, were they under control and were corrective actions recorded? The actual HACCP

system can be verified by regular inspections, internal and external audits.

+ Validation of process steps by sampling and testing of CCP's, such as deliver applied process conditions required conditions (time and temperature conditions in the products? Microbial analysis can be conducted to validate food safety, or storage experiments can be applied to confirm product shelf life.

+ Calibration of equipment to check functioning of measuring equipment is part of verification.

+ Checking of training and knowledge of personnel responsible for monitoring CCP's.

2.12 Establishment of record keeping and documentation (principle 7)

- Did the team perform documentation and record keeping for the HACCP system?

+ Documentation was process flow diagrams, conductance of hazard and CCP analysis.

+ Records included information about used ingredients, processing data, specifications of packaging materials, temperature records of storage and distribution, deviation and proceeded corrective action records and employee training records.

C. THE EMPTY TABLES TO FILL THE TEST RESULTS AND OTHER INFORMATION

Table 1 General information of the company

Company characteristics
Date of establishment:
Located in:
Business scope:
Quality certificated:
Main export market:
Production technology:
Labor force:
Freezing capacity:
Distribution:
Company's quality policy:
Main facilities:
Main products:
Company's advantages:
Company's disadvantages:

Managerial structure
Managerial staffs: ***(%)*** *Level of education:* - University level: (%) - Intermediate level: (%) - Other: (%) *Quality management training:* - For managers: (%) - For employees: (%)

Table 2 Supplier and Quality Systems of the company

Supplier Quality Management
Criteria to choose suppliers:
Participating with the suppliers:
Evaluating the performance of the suppliers:
Auditing supplier quality:
Improving supplier quality:
Communicating with the suppliers:
Quality systems
Quality systems:
Level of implementation of each system (%):
Limitations to these quality systems:

Level of technological investment
Kinds of invested equipment and technology:
Current need for TI (% of the need):
Technological and equipment problems:

Table 3 Test results of HACCP implementation at the company

HACCP implementation in the companies
Prerequisite programs (GMP and SSOP)
HACCP implementation 13. HACCP team: (people) 14. Describe the products and its distribution: 15. Identification of intended use and consumers: - Market segments: - Potential risks: 16. Development of process flow diagrams: 17. On-site verification of flow diagram: 18. Conducting of a hazard analysis in the company (principle 1): 19. Determination of Critical Control Point (CCP's) (principle 2): 20. Establishment of critical limits for each CCP (principle 3): 21. Establishment of a monitoring system for each CCP (principle 4): 22. Establishment of a corrective action plan (principle 5): 23. Verification of the HACCP plan (principle 6): 24. Establishment of record keeping and documentation (principle 7):

Table 4 The support of VASEP, NAFIQAVED and local departments

Support activities of VASEP - What activities of VASEP to support the company?
Support activities of NAFIQAVED - What activities of NAFIQAVED to support the company?
Support activities of extension centre - What activities of local departments especially extension centre to support the company?

Table 5 Conditions of distribution stage

Storage conditions - Inside the company - Rented warehouses
Transportation conditions - Of the company (%) - Rented transportation

D. THE WAY TO FULFILL THE EMPTY TABLES

1. For table 1:

- Using the information from company's profile and secondary data

2. For table 2:

- Interviewing company's leaders and quality control staffs for each content along with company's reports.
- Using detail contents shown in the appendix 7, part B1

3. For table 3:

- Combining practical observations and interviews (quality control staffs and workers during the HACCP procedure
- Using company's documents and reports of HACCP implementation
- Using detail contents shown in the appendix 7, part B2. Each content has many topics to observe. The total topics of each content are let 100%, then calculate the frequency of the number of implemented topics to the total.

4. For table 4 and 5:

- Interviewing company's leaders and quality control staffs for each content along with company's reports.

For example, the test result of conducting of a hazard analysis in the company (principle 1) mentioned in the part 6 of the table 6.3 of the company A is "30% of the contents of this section implemented". Calculating this percentage based on total topics of the part 6, the content of conducting of a hazard analysis in the company (principle 1), is 21 while practical observations are only 6 topics implemented (approximately 30%). Gap analysis in chapter 6 would explain the level of implementation and the reasons why.

Appendix 8

Questions For Chain Actors' Interviews

1. Main questions to interview farmer/farmer association:

1.1 Do you know any idea regarding how to grow high quality product?
1.2 Who help you to know? How about local management and Extension centre?
1.3 Where do you buy shrimp seed and how do you realise shrimp seed quality?
1.4 How do you test the shrimp seed and final product?
1.5 Do you receive any document related to forbidden Anti-biotic? and from where?
1.6 Do extension staffs help you to grow "clean product"? and how?
1.7 Who controls and investigate during your growing time?
1.8 From where do you buy feed? And you have any help about techniques from them?
1.9 Who buys you product?
1.10 And do you have any help from SFCs?
1.11 What do you think about fisheries culture planning with large scale?
1.12 What do you suggest for getting high product quality with high price?

2. Main questions to interview collector:

2.1 Where do you buy product? And how do you know the right time to harvest the product?
2.2 How do you recognise "clean product" before buying?
2.3 Where do you sell your product – wholesale buyer or SFC?
2.4 Do you receive any help from wholesale buyer and SFCs?
2.5 How about your means for maintaining and ensuring product quality?
2.6 Do you agree your product is easy to infect the hazards? And how do you control this?
2.7 What do you suggest for getting high product quality?

3. Main questions to interview wholesale buyer:

3.1 How are close relations between you and SFCs?
3.2 What do they help you to buy "clean product"?
3.3 What do you help your collector to buy clean product?

3.4 What policies to keep high product quality of SFCs applied to you and your collectors?
3.5 Is there any relation between you and local management in ensuring product quality and safety?
3.6 Which means do you use and support your collectors to maintain product quality?
3.7 What methods do you use to control your collector's product quality?
3.8 What do you suggest for getting high product quality?

4. Main questions to interview feed wholesaler:

4.1 Do you know clearly about your product quality?
4.2 There is any combination between your agency with farmer and local departments to help the farmer? And how? Is it necessary?
4.3 Do you play a role as wholesale buyer for any SFC? What benefit regarding product quality and safety?
4.4 Do you know any affection from your feed product to seafood quality grown at the field?
4.5 What do you think that can improve farmer's product quality to meet market requirements?

5. Main questions to interview SFCs:

5.1 How do you buy clean product?
5.2 What methods to control and maintain high quality materials from your wholesale buyers, collectors and farmers?
5.3 Is there any relation between SFC, VASEP, NAFIQAVED and local management for control product quality? And how?
5.4 How about quality management and technological investment for quality improvement in your chain?
5.5 Is there any partnership with other SFCs? What kind of partnerships?
5.6 How about your transportation means and storage conditions?
5.7 What do you want to suggest more for quality improvement in the whole chain?

6. Main questions to interview NAFIQAVED:

6.1 For whom centres of NAFIQAVED implement their responsibilities? Which aspects?
6.2 How about technology and equipment at the centre?
6.3 How to control and manage hazard infection in provinces?
6.4 What is responsible for SFCs' support?
6.5 How to combine management of the centre, local government as well as other support organisations?
6.6 How about market requirements about test level of the hazards?
6.7 What do you think about fisheries culture planning with large scale and relevant issues?

6.8 What do you suggest for quality improvement inside the centre and for the whole chain?

7. Main questions to interview VASEP:

7.1 What areas do you concern for seafood quality and safety regarding management and technology?
7.2 Which policies issued for this goal? And for whom?
7.3 How to implement them?
7.4 How to test and control them?
7.5 How to evaluate the implementation?
7.6 What is linkage between VASEP and other managerial units for quality assurance objectives?
7.7 What do you think about fisheries culture planning with large scale and relevant issues?
7.8 What are your suggestions for seafood supply chain quality improvement?

8. Main questions to interview the Extension Centre and Fisheries Department:

8.1 What areas of fisheries quality and safety do you manage and control in primary production?
8.2 How do you expand them to farmers? How about knowing their implementation and audit?
8.3 How do you know the feedback?
8.4 What areas do you link with other chain organisations (mostly NAFIQAVED) to manage seafood quality and safety?
8.5 How about test technology and equipment to help farmers?
8.6 What do you think about fisheries culture planning with large scale and relevant issues?
8.7 What do you suggest for more safe, clean and high quality of products in management and technology?

9. Main questions to interview Expert:

9.1 According to your experience, what managerial aspects in the chain need to focus on seafood quality and safety? Who is involved? And why?
9.2 How about technology investment?
9.3 What is the most important management for seafood safety and quality in primary production? In SFCs? And in other stages of the chain?
9.4 What do you think about fisheries culture planning with large scale and relevant issues?
9.5 What are your suggestions for seafood quality improvement?

Summary

The thesis has seven chapters. Chapter 1 provides an overview of global trends in food safety and quality assurance, Vietnam's fisheries industry situation and shrimp supply chain quality problems in the MD. Because customers now demand high levels of quality and safety in food production, manufacturers and exporters must raise the standard of effective quality control systems in the food industry, especially the standard of HACCP systems. Seafood supply chains in Vietnam in general and the shrimp supply chains in particular still have major quality problems. An important problem, due to hazards found in products from primary production through to distribution, is the risk of infection. The problems are related to the managerial and technological aspects of HACCP system implementation. There is a lack of strict quality management by the SFCs. The SFCs do not sufficiently control the input from the primary production part of the chain. Government and support organizations have insufficient possibilities to realize a good infrastructure for quality. Knowledge of quality management is insufficient. The possibilities to invest in good technology are limited. Chapter 1 gives also the research objectives, and explains the eight research steps.

Chapter 2 provides a research literature review. The literature includes theories and concepts that refer to the role of HACCP in food supply chains. It includes also references to literature that stresses the necessity of integrating technological problems and managerial problems (the techno-managerial approach). In addition, the combination of quality management and supply chain management and the PDCA cycle for implementing quality improvement are also essential. The chapter has also revealed the important role played by government and other relevant organizations in the food safety chain as support organizations for successful implementation of an HACCP program and for food chain safety.

Chapter 3 gives the survey results of 32 SFCs in the MD. The results contain all the data and information about shrimp quality management and HACCP implementation. These data and information also describe the shrimp supply chain quality problems found at the hatchery, farm, collector and wholesale buyer stages. The role of government, industry, local departments, NAFIQAVED, and VASEP are crucial in ensuring seafood safety and quality in the entire chain. This is also included in the survey. The chapter gives an overview of the quality problems in the subsequent stages of the supply chain.

Chapter 4 introduces the framework for seafood supply chain quality management through the techno-managerial approach. It consists of an SFC part and a primary production part. The diagnosis phase of the framework focuses mainly on the SFC quality management measures, of which quality assurance by means of the HACCP tool is crucial. Measures for improving the HACCP system regarding management, technology and organizational behaviour are also suggested. The improvement phase extends to the primary production part of the chain. All chain actors (farmer, collector, wholesale buyer, feed wholesaler, SFC, NAFIQAVED branches, VASEP, the Extension Centre, Fisheries Department) are included here.

Chapter 5 uses the framework to diagnose the quality management problems at SFC level. Part of the framework has been tested in two SFCs in the MD: a state-owned company and a joint stock company. The test focuses mainly on the 12-stage procedure and the principles of an HACCP implementation. Throughout the test, many gaps and deficiencies were identified. Gaps in quality were found inside the companies and various deficiencies were found in the stakeholder management of the shrimp supply chain. In addition, the deficiencies at VASEP, NAFIQAVED, FRDP, the Fisheries Department and the Extension Centre in supporting and facilitating the SFCs are also described in detail.

Chapter 6 describes the quality improvement phase. It includes the quality improvement process in the company and measures for chain quality improvement. The company quality improvement process consists of nine steps for conducting the quality improvement procedure in general terms. The possibilities for the chain quality improvement are based on interviews with all kinds of chain actors and shrimp supply chain experts. Chain interviewees include farmer, farmer association, collector, wholesale buyer, feed wholesaler, SFC, NAFIQAVED branches, VASEP, the Extension Centre, Fisheries Department, and fisheries experts.

Chapter 7 presents the research conclusions and recommendations.

Samenvatting

Het proefschrift bestaat uit zeven hoofdstukken. Hoofdstuk 1 geeft een overzicht van de globale trends in voedselveiligheid en kwaliteitsborging. Het gaat in op de Vietnamese visserij in het algemeen en op de garnalenketen in de Mekong Delta in het bijzonder. Omdat klanten hoge eisen stellen aan kwaliteit en veiligheid in voedselproductie, moeten ook producenten en exporteurs de standaard voor effectieve kwaliteitsbeheersing verhogen. Het gaat daarbij vooral om de invoering van HACCP systemen. In de Vietnamese visketens en met name in de garnalenketen zijn er nog grote kwaliteitsproblemen. Een belangrijk gevaar is het risico van infectie. De problemen zijn gerelateerd aan tekortkomingen in zowel de management aspecten als de technologische aspecten van HACCP implementatie. Er is gebrek aan strikt kwaliteitsmanagement in de verwerkingsbedrijven. De bedrijven beheersen ook onvoldoende de input vanuit het primaire productie deel van de keten. Overheid en intermediaire organisaties hebben onvoldoende mogelijkheden om een goede infrastructuur voor kwaliteit te realiseren. De mogelijkheden om te investeren in goede technologie zijn beperkt. Hoofdsuk 1 geeft ook de onderzoekdoelen en legt de onderzoekstappen uit.

Hoofdstuk 2 geeft een literatuur overzicht. Daarin wordt eerst ingegaan op de rol van HACCP in voedselketens. Er wordt ook aandacht besteed aan literatuur waarin de noodzaak wordt besproken van integratie van technologische problemen en management problemen (de techno-managerial aanpak). Bovendien wordt aangesloten bij literatuur waarin het belang van combinatie van kwaliteitsmanagement en supply chain management wordt besproken. Daarbij wordt ook ingegaan op het belang van de PDCA cyclus voor het implementeren van kwaliteitsverbetering. Het hoofdstuk gaat ook in op het belang van de overheid en andere intermediaire organisaies voor een succesvolle invoering van een HACCP programma voor voedselveiligheid in de keten.

Hoofdstuk 3 geeft de resultaten van het survey onderzoek bij de 32 garnalen verwerkingsbedrijven in de Mekong Delta. De resultaten geven een overzicht van de kwaliteitsbeheersing en de invoering van HACCP. Er wordt ook een beschrijving gegeven van de kwaliteitsproblemen die ontstaan in kwekerij, mestbedrijven en tussenhandel. De rol van centrale en lokale overheid, van NAVIQAVED en VASEP zijn cruciaal in het garanderen van veiligheid en kwaliteit in de hele keten. Het hoofdstuk geeft een systematisch overzicht van de kwaliteitsproblemen in de opeenvolgende schakels in de keten.

Hoofdstuk 4 introduceert een raamwerk voor supply chain kwaliteitsmanagement. Daarbij wordt een techno-managerial aanpak gevolgd. Het raamwerk bestaat uit een primair productie deel en een verwerkingsdeel. In de diagnosefase valt de nadruk op de verwerkingsbedrijven. Kwaliteitsborging door middel van HACCP is daarbij cruciaal. Om het HACCP systeem te verbeteren, worden technologische maatregelen gesuggereerd, management maatregelen en algemeen organisatorische maatregelen. In de verbeterfase wordt ook aandacht gegeven aan het primaire productie deel van de keten. Aan alle keten actoren (kweker, mester, tussenhandel, visvoer leverancier, verwerkingsbedrijf, NAFIQAVED vestigingen, VASEP, onderzoek- en trainingscentra en het Ministerie van Visserij) wordt daarbij aandacht gegeven.

Hoofdstuk 5 gebruikt het raamwerk om de problemen met betrekking tot kwaliteitsmanagement in de verwerkingsfase te diagnosticeren. Het raamwerk is getest in twee verwerkingsbedrijven in de Mekong Delta: een staatsbedrijf en een geprivatiseerd bedrijf. De test richt zich met name op de 12-staps procedure voor HACCP implementatie, en op de bijbehorende principes. In de test komen verschillende tekortkomingen naar voren, zowel in de verwerkingsbedrijven als bij de toeleverende bedrijven. Ook de tekortkomingen van VASEP, NAFIQAVED, het Ministerie van Visserij en de onderzoek- en trainingscentra in hun ondersteuning en facilitering worden beschreven.

Hoofdstuk 6 beschrijft de kwaliteits verbeterfase. Dat omvat de kwaliteitsverbetering in de verwerkingsbedrijven en in de primaire productie. Het kwaliteitsverbeterproces in de verwerkingsbedrijven bestaat uit 9 generiek geformuleerde stappen. De mogelijkheden voor de verbetering van ketenkwaliteit zijn gebaseerd op een uitgebreide verzameling interviews met alle soorten van keten actoren: garnalenboeren, associaties van garnalenboeren, tussenhandel, verwerkingsbedrijven, NAFIQAVED, VASEP, onderzoek- en trainingscentra, Ministerie van Visserij. Ook visserij experts zijn bij de interviewronde betrokken.

Hoofdstuk 7 geeft onderzoek conclusies en aanbevelingen.

Tóm Tắt

Luận án gồm có bảy chương. Chương 1 cung cấp thông tin liên quan đến xu hướng toàn cầu về bảo đảm an toàn và chất lượng thực phẩm, về tình hình ngành thủy sản Việt Nam, và những vấn đề liên quan đến chất lượng hàng thủy sản nói chung và sản phẩm tôm nói riêng ở đồng bằng sông Cửu Long (ĐBSCL). Do đòi hỏi ngày càng cao của khách hàng về an toàn và chất lượng trong sản xuất thực phẩm nên các nhà chế biến và xuất khẩu cần nâng cao hệ thống kiểm soát chất lượng đặc biệt là thực hiện hệ thống HACCP (Phân tích mối nguy và điểm tới hạn) một cách chặt chẽ và hiệu quả. Qui trình sản xuất thủy sản nói chung và tôm nói riêng từ ao nuôi tới bàn ăn ở Việt Nam còn gặp nhiều khó khăn trong việc bảo đảm an toàn và chất lượng. Trong mỗi khâu sản xuất của qui trình này, sản phẩm vẫn còn bị nhiễm bởi các mối nguy sinh học, vật lý và hóa học. Nguyên nhân lây nhiễm chính xuất phát từ các vấn đề quản lý và đầu tư công nghệ trong việc thực hiện chương trình HACCP. Các công ty xuất khẩu thủy sản chưa thể thực hiện chương trình HACCP ở khâu nuôi trồng. Mặt khác, quản lý của địa phương về an toàn và chất lượng sản phẩm nuôi trồng còn lỏng lẻo. Hơn nữa, VASEP (Hiệp Hội Chế Biến và Xuất Khẩu Thủy Sản Việt Nam) và NAFIQAVED (Cục Quản lý Chất lượng, An toàn Vệ sinh và Thú y Thủy sản) vẫn còn hạn chế về nguồn lực để phục vụ mục tiêu bảo đảm an toàn chất lượng thủy sản cả nước. Ngoài ra, chương 1 còn đề cập đến mục tiêu nghiên cứu của luận án và giải thích tám bước để thực hiện luận án này.

Chương 2 trình bày các cơ sở lý luận để giải quyết các vấn đề của luận án. Các cơ sở này bao gồm lý thuyết và khái niệm về vai trò của hệ thống HACCP trong sản xuất thực phẩm từ ao nuôi tới bàn ăn; về sự kết hợp các vấn đề trong quản lý và công nghệ; kết hợp giữa quản lý chất lượng và quản lý sản xuất; và về việc thực hiện phương pháp "PDCA cycle" (hoạch định, thực hiện, kiểm tra và đánh giá) trong việc cải tiến và nâng cao chất lượng. Chương 2 cũng đề cập đến vai trò quan trọng của chính phủ và các tổ chức hỗ trợ để thực hiện thành công chương trình HACCP phục vụ mục tiêu bảo đảm an toàn chất lượng.

Chương 3 trình bày kết quả điều tra 32 công ty xuất khẩu thủy sản ở ĐBSCL bao gồm những thông tin liên quan đến quản trị chất lượng tôm và thực hiện chương trình HACCP ở các công ty xuất khẩu thủy sản. Những thông tin này mô tả những vấn đề về chất lượng tôm từ khâu sản xuất giống tôm, khâu nuôi tôm, người thu gom và đại lý mua tôm. Ngoài ra, chương 3 còn đề cập đến vai trò quan trọng của chính phủ, ngành thủy sản, chính quyền địa phương,

NAFIQAVED và VASEP trong việc bảo đảm an toàn và chất lượng hàng thủy sản từ khâu nuôi trồng đến bàn ăn.

Chương 4 giới thiệu mô hình quản lý chất lượng sản phẩm thủy sản từ ao nuôi tới bàn ăn dựa vào cách tiếp cận quản lý và công nghệ (Techno-managerial approach). Mô hình bao gồm hoạt động quản lý chất lượng trong các công ty xuất khẩu thủy sản ở ĐBSCL, trong khâu nuôi trồng, và các giải pháp cải tiến và nâng cao chất lượng sản phẩm thủy sản từ khâu nuôi trồng đến khâu chế biến. Đặc biệt các giải pháp nâng cao hệ thống quản lý HACCP, cải tiến công nghệ và hành vi tổ chức về chất lượng trong các công ty xuất khẩu thủy sản được nhấn mạnh.

Chương 5 mô tả kết quả thử nghiệm mô hình quản lý chất lượng thuộc hai công ty xuất khẩu thủy sản ở ĐBSCL - một công ty nhà nước và một công ty cổ phần. Thử nghiệm tập trung vào 12 bước của các nguyên lý và tiến trình thực hiện HACCP. Khi so sánh với mục tiêu chất lượng của công ty, kết quả thử nghiệm cho thấy còn nhiều thiếu sót trong quản lý chất lượng và an toàn sản phẩm. Vì vậy, chương này còn mô tả chi tiết các thiếu sót về bảo đảm chất lượng cần được cải tiến và nâng cao.

Chương 6 trình bày mô hình chín bước nâng cao chất lượng sản phẩm trong các công ty xuất khẩu thủy sản và các giải pháp tiềm năng để nâng cao chất lượng sản phẩm ở khâu nuôi trồng.

Chương 7 tóm tắt kết luận và kiến nghị của luận án.

Stellingen

behorende bij het proefschrift

Equitisation and Stock-Market Development

The Case of Vietnam Truong Dong Loc

1. Privatisation is the most efficient way to restructure gOEs in order to improve their performance in transition economies.

2. Equitisation has positive effects on firm performance in Vietnam, notwithstanding the fact that equitisation in Vietnam differs from privatisation in most other transition and non-transition economies in that residual state ownership after equitisation and the percentage of shares transferred to insiders are quite substantial.

3. The difference-in-differences (DID) method is a well-developed approach to overcome shortcomings of the pre-post comparison method in measuring effects of a policy or policy programme.

4. Emerging stock markets are usually inefficient even in the weak form, possibly implying that investors would be able to obtain abnormal returns by establishing trading strategies based on information about past price patterns.

5. A daily seasonal anomaly is present in the Vietnamese stock market in the form of a negative Tuesday effect.

6. Accession to the World Trade Organisation provides Vietnam both with opportunities and challenges.

7. The most difficult part in doing research in Vietnam, especially in corporate finance, is collection of data.

8. Microfinance is an effective instrument to improve the livelihoods and to reduce poverty in developing countries.

9. Corruption is a serious problem that has stalled economic growth of poor countries in general and of Vietnam in particular.

10. Beauty is only skin-deep (Vietnamese saying).